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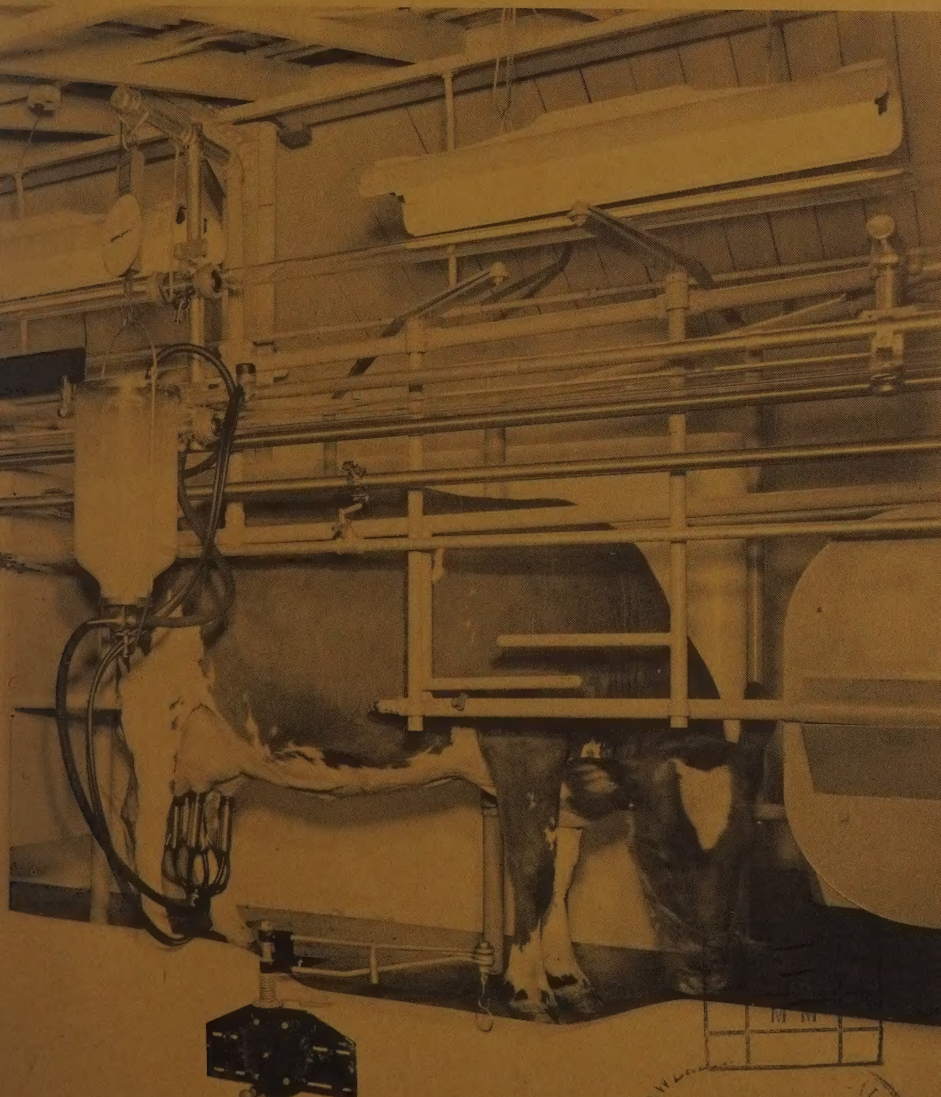

"PUSHBUTTON" MILKING

DEC 1957

STATE OF CALIFORNIA
GOODWIN J. KNIGHT, *Governor*
HAROLD J. POWERS, *Lieutenant Governor*

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OUR COVER: Modern pipeline milking system demonstrated at the California State Fair

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"Pushbutton" Milking

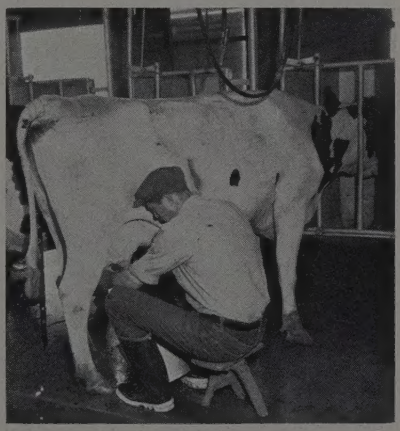
By A. E. REYNOLDS, Assistant Chief, Bureau of Dairy Service

The dairy cow is considered by many responsible authorities to be the most amazing and beneficial of all farm animals. She not only produces nature's most nearly perfect food—milk—but she does it by consuming grass and roughage which is worthless as human food. The cow is one of the most efficient factories known, and the physiology of milk production, how the cow makes milk, is one of nature's fascinating phenomena.

The cow's udder is divided into four separate and distinct quarters; each quarter is independent. Millions of tiny cells in the udder convert certain contents of the blood into milk composed of fat, carbohydrates, proteins, minerals and vitamins. This process is going on night and day during the lactation period. The milk accumulates in very small cisterns, called alveoli, and is held there until the animal is stimulated prior to milking. This "stimulating" process is complicated but very important in milk secretion. It is essential that it be thoroughly understood by dairymen, because successful herd management depends on a knowledge of what "goes on" inside the cow.

Milk "letdown" is caused by the nerves in the udder which excite the pituitary gland, located near the cow's brain. When the brain receives a signal that the cow is ready to be milked, this gland releases into the blood stream oxytocin, a hormone that causes the muscles surrounding the alveoli to squeeze out the milk into large ducts where it is ready to be drawn through the teat canal. Once this process is understood, the dairyman is able to take full advantage of nature's help in milking by gently massaging the udder just prior to applying the teat cups of the milking machine. This massaging process, applied just after the cow is washed, consists of manipulating the udder with a soft cellulose sponge soaked in warm water (usually containing some sanitizing agent), leaving the teats damp-dry. The teat cups are applied immediately after each teat is primed. Priming means milking out the first two or three streams of milk by hand. Many dairymen milk the first stream into a strip cup—a device consisting of a black circular metal flange or fine-mesh screen mounted over a cup. This milk is observed for any abnormalties which may be present, such as curdiness or flakiness, indicative of mastitis, or bloody milk, caused by injury to the udder. Should any of these symptoms appear, the cow is removed from the milking string for treatment, and her milk is kept out of the supply intended for human consumption.

To milk a cow by hand requires an estimated 1,235 flexes or squeezes. Hand milking is a tiring, monotonous, time-consuming, uneconomical method of harvesting nature's important food crop. Man's search for a better way to do this job, mechanically, dates back to 1878 when Anna Baldwin was



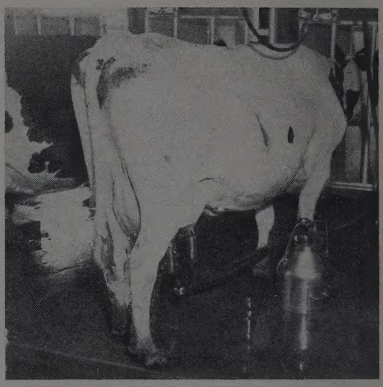
The antique method of milking contrasted by modern surroundings.

granted a U. S. patent on a suction type milking machine, patterned after the old familiar hand water pump. This machine was not practical but it did start people thinking that there may be a way which would eliminate the back-breaking job of milking by hand.

The forerunner of today's modern milker was developed in 1894; however, many experimental models were tried and discarded before a successful machine was designed. In fact, one large company spent 24 years in continuous research before perfecting a practical, foolproof milking machine.

Cows were never made to be milked by hand or by machine, but intended to be suckled by the calf; so the milking machine is designed to simulate the calf sucking its mother.

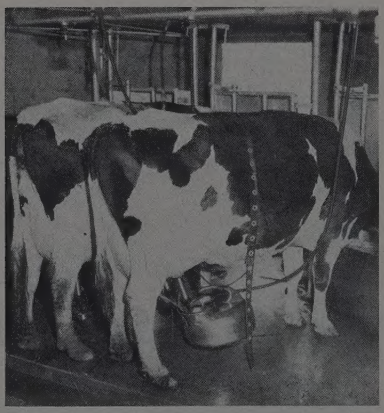
The modern milking machine consists of four (two in the case of the goat machines) elongated, pliable, rubber cups, open at one end and tapering to a small tube at the other; these are shaped to fit the cow's teats. The rubber teat cups, called inflations, each fit into a metal teat cup liner or shell. A vacuum is supplied to the teat cups in two phases. One phase collapses the inflation at intervals of 45 to 48 times a minute. This intermittent action is produced by a pulsator which uniformly makes and breaks the vacuum. The collapsed inflation massages the teat which aids blood circulation. The second phase applies a steady vacuum to the tube end of the inflation which sucks the milk into a milk tube leading to a bucket, also under vacuum. Each teat cup is operated independently and can be removed as soon as the "quarter" is milked out.



Conventional bucket unit where milk travels from the cow to the bucket through flexible tubing.

When properly operated, a machine can milk a cow in three to four minutes. Fast milking is very important because the effect of the oxytocin ("milk letdown" hormone) wears off within a few minutes after the udder is stimulated and actual milking begins. Once the hormone is depleted, the ability of the cow to "give down" her milk diminishes, and there is a chance that milk may remain in the udder. As soon as each quarter is milked out, the teat cups should be removed, because a machine operating on an empty udder can set up an irritation in the teat canal which in turn will open an avenue for infection. The proper way to determine if the quarter is milked out is simply by feeling the udder. The udder can be compared to a large sponge. Before milking it is full, tight and expanded, and when milked out it becomes relaxed and shrunken.

There are two important reasons why each quarter should be completely milked out at every milking. First, the final milk to be removed is very rich in milk fat, the expensive ingredient in milk which is a principal factor used to determine the price received. Secondly, any milk left in the



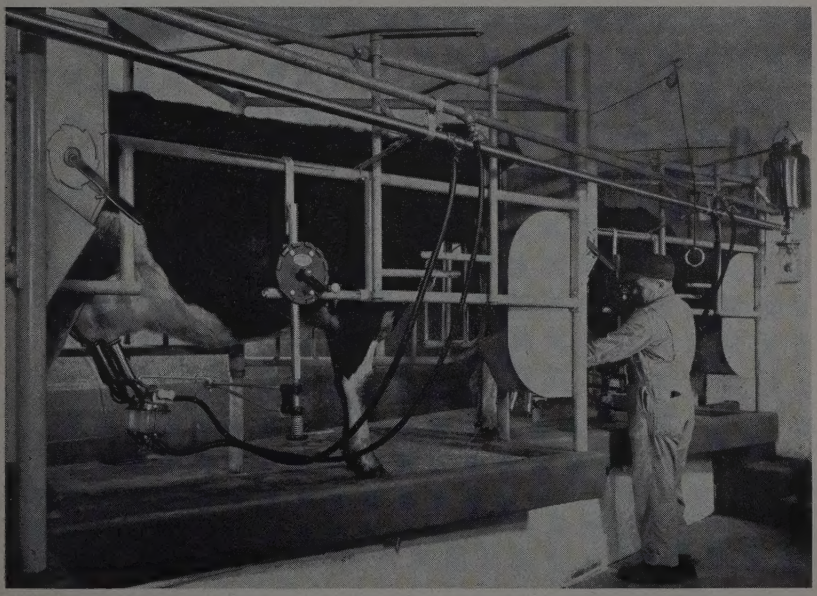
Milk bucket and teat-cup assembly suspended from cow by adjustable surcingle (perforated belt). This system eliminates need for long milk tubes.

udder will have a tendency to dry up the animal prematurely. The final milk to be removed from the udder is commonly referred to as "strippings," and until a few years ago it was thought that hand stripping was necessary after the removal of the milking machines. This theory has now been largely abandoned in favor of machine stripping. This is accomplished by pulling down on the teat cup cluster with one hand and massaging the quarters with the other. This system has not only proven satisfactory from the standpoint of keeping production up but is faster, requires less hand labor and is more sanitary.

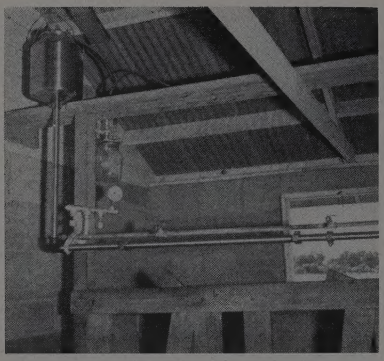
The milking machine has been perfected to a high degree and is considered the most important equipment on a dairy. Hand milking in California is a curiosity now, and even where only a few cows are kept the milking machine is employed.

Some of the first practical milking machines are still in use today. They are commonly referred to as the bucket type because the milk is drawn into a bucket under vacuum. The milking procedure in using this type of machine is to carry the filled bucket to the milkhouse, where the warm milk is poured over a cooler. As a general rule, the milk is poured into a covered hopper located just outside the milkhouse wall, where it is piped into the milkhouse to a spreader trough located just over a cooler. Some coolers are refrigerated with tap water, which provides enough cooling for manufacturing class milk. Market class milk, on the other hand, is required to be cooled to 50 degrees F. or below as soon as it is drawn from the cow, so a more efficient cooling system must be employed. Coolers of this type generally operate on ammonia, freon, or methyl chloride gas.

Carrying each bucket of milk to the milkhouse and returning to the barn involves a lot of time, foot travel and heavy lifting. To make the job easier and to speed up the milking process, the "pipeline milker" was developed. This system utilizes the same equipment for milking the animals except that the bucket has been eliminated; instead of the milk accumulating in a bucket, it is taken directly from the cow, sucked into a sanitary pipeline of stainless steel or suitable heat-resistant glass and conveyed into



Pipeline system in use. Completely automatic, the milk is never exposed to atmosphere. Note the handy position of cows on elevated platform.



Stainless steel elevated wash tank at end of milking barn used in the vacuum gravity or "push-pull" cleaned-in-place system.

the milkhouse either by vacuum or by vacuum and pressure.

This system of milking was first started in New Zealand and introduced into the United States a few years later. Along with this new milking method came many problems which had to be solved by dairymen, inspectors, equipment engineers and milk processors. Until the pipeline milker made its appearance, inspectors enforcing the provisions of the Agricultural Code having to do with clean milk production required all equipment coming in contact with the milk to be disassembled, rinsed, washed, sterilized and drained after each milking. It was soon realized that a major enforcement problem would be presented if the dairymen were to meet such requirements on the pipeline milker. Dismantling each pipe joint, fitting and valve twice a day for cleaning was a time-consuming, tedious job which was sure to be slighted.

Realizing this, the enforcement officials and industry representatives took the lead in developing a system which could be cleaned in place. Thus a new alphabetical combination was born: C. I. P., meaning cleaned in place.

It was apparent from the start that C. I. P. systems would require strict regulation because they were not only complicated mechanically but for economic reasons there was a temptation to convert equipment which was never designed for the purpose. Every conceivable method of cleaning was tried under the supervision of the inspection agencies.

Early trials of C. I. P. systems produced some important findings which resulted in changes of practice and materials heretofore used in cleaning milking equipment.

Some of the more important findings were:

1. Acid and alkaline cleaning solutions would very soon etch out and destroy a return pipeline unless it was made of noncorrosive material such as heat-resistant glass or stainless steel. This meant that all galvanized pipe, originally used for many of the solution return lines, would not stand up.

2. The well-established fact that milk will become oxidized when in contact with certain metals was brought out in the trials. Oxidized milk has a very distasteful flavor. The end result was that bronze, brass and copper fittings and equipment would not stand up. Monel or white metal commonly used for milk lines was not acceptable, and tinned copper was not safe because the tin soon wore off and exposed the copper.

3. Cleaning solutions had to have a turbulence sufficient to dislodge all accumulated milk solids anywhere in the system.

4. Certain types of cleaners would not do a good job.

5. Overuse of synthetic detergents caused foaming action to the point of ineffectiveness.

6. Temperatures of solutions had to be adjusted to the type of cleaning material used as well as to the type of equipment cleaned.

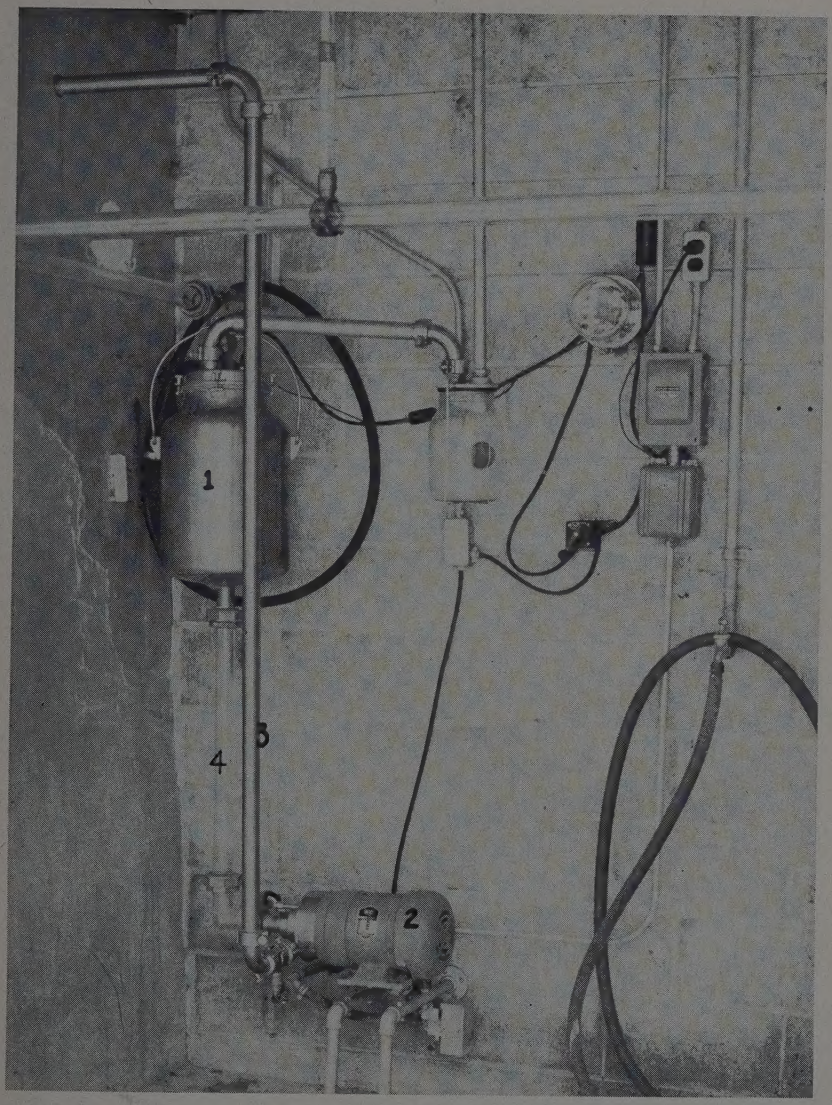
7. A more thorough cleaning job could be accomplished if the entire system was flushed out with lukewarm water immediately after milking.

8. Vacuum lines extending in a vertical direction from the top of an air separator (vacuum receptacle where milk accumulates prior to being pumped out) would hold condensate from the warm milk and, unless taken apart for cleaning after each milking, would cause a high bacteria count.

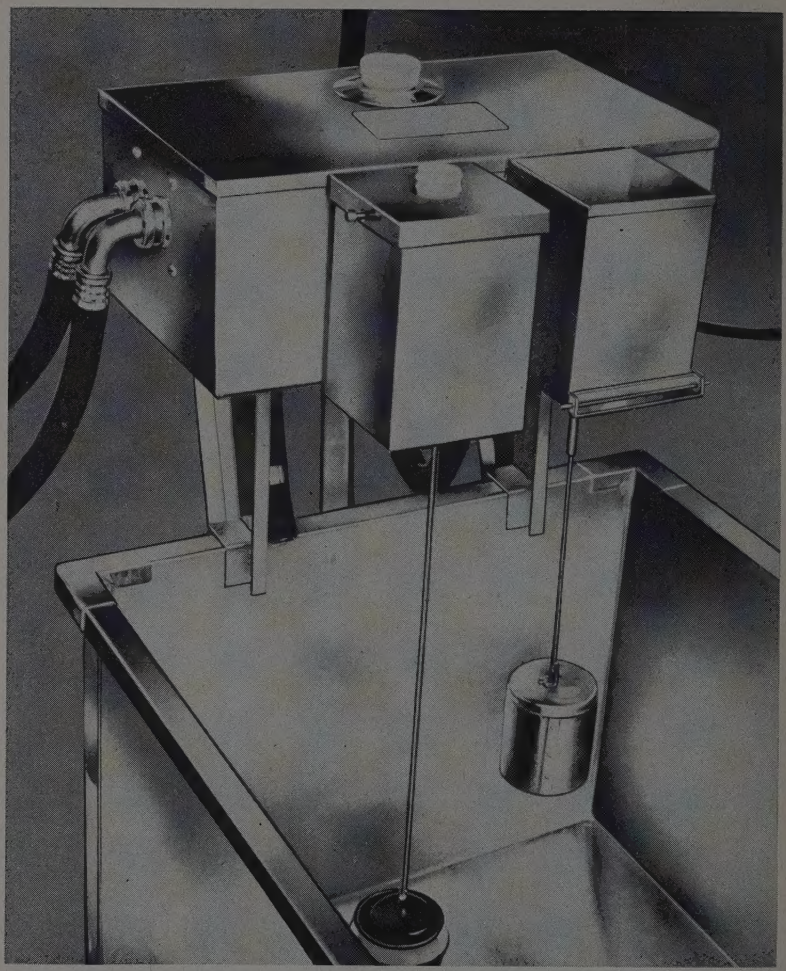
9. The entire pipeline milking system must have a positive slope to a low point to permit complete drainage.

10. Pipelines must be supported to prevent swales where solutions would lodge and fail to drain.

11. All joints must be connected with an acceptable gasket made of some low-absorbent or nonabsorbent material forming interior connections that would be flush, smooth and seamless.



Some of the machinery necessary to the operation of a pipeline milking system. Milk accumulates in stainless steel vacuum tank (1) and is removed by sanitary milk pump (2). Note that both stainless steel (3) and glass (4) pipelines are employed. Pump is used to circulate washing and sterilizing solutions during the cleaning process.



Closeup of an automatic cleaning system. Liquid detergent is added to one of the small tanks and sterilizing material to the other. The dial is set and a switch turned on. Pipelines and milking equipment are rinsed, washed, sterilized and drained automatically.

12. Waterlines must not be connected permanently to the system, because a leaky water valve would allow water to be sucked into the milkline during milking.

13. All connections must be of sanitary construction and easy to disassemble.

As a result of the C. I. P. trials and experiments, dairymen, agricultural experiment station officials, equipment manufacturers, enforcement officials and others were in agreement that the Director of the California Department of Agriculture should hold

hearings to consider the adoption of regulations which would require all C. I. P. milk pipeline systems to comply with all features necessary to the production of clean, wholesome milk. As far as we know, California was the first state to adopt C. I. P. regulations and is known as the leader in this field.

There are three basic types of C. I. P. methods in use today: the vacuum-gravity or "push-pull," the "air brush" and the circulation.

Vacuum-gravity Method

The vacuum-gravity method consists of one or more stainless steel tanks (under vacuum) placed at a high point in the end of the barn opposite the milkhouse. A second stainless steel tank system is located in the washroom. This second tank system contains the cleaning and sterilizing solutions, and for purposes of explanation will be referred to as the starting point in the C. I. P. cleaning process.

After milking, the milklines, teat-cup assemblies and milk tubes are connected to the tank systems, and a vacuum is drawn on the elevated tanks at the end of the barn. The vacuum in turn draws the cleaning solution from the starting point, through the various lines, and into the elevated tanks. When the elevated tanks are filled with solution a float trips a relief valve, breaking the vacuum. This allows the solution to return by gravity to the starting point. As soon as the elevated tank is empty a valve automatically closes the system and the process is repeated. This is sometimes referred to as the "push-pull" method. It is fully automatic except that milk cocks must be washed and sterilized individually.

Vacuum "Air Brush" Method

The vacuum "air brush" method is similar to the vacuum-gravity in some respects. A solution tank is located in the washroom of the milkhouse and is the starting point of the cleaning process. Various cleaning and sterilizing agents are drawn from the solution tank, through the pipes, lines, milk tubes and teat-cup assemblies to an air separator or releaser. The solutions are returned through the lines by pump or gravity. One basic difference in the two systems discussed thus far is the fact that, in the "air brush" method, air is forced into the solution at regular intervals, causing a violent turbulence which aids the cleaning action. Milk cocks in this system are included in the C. I. P. by applying specially designed plastic tubes which cause the solution to encompass the area which requires cleaning.

The Circulating Method

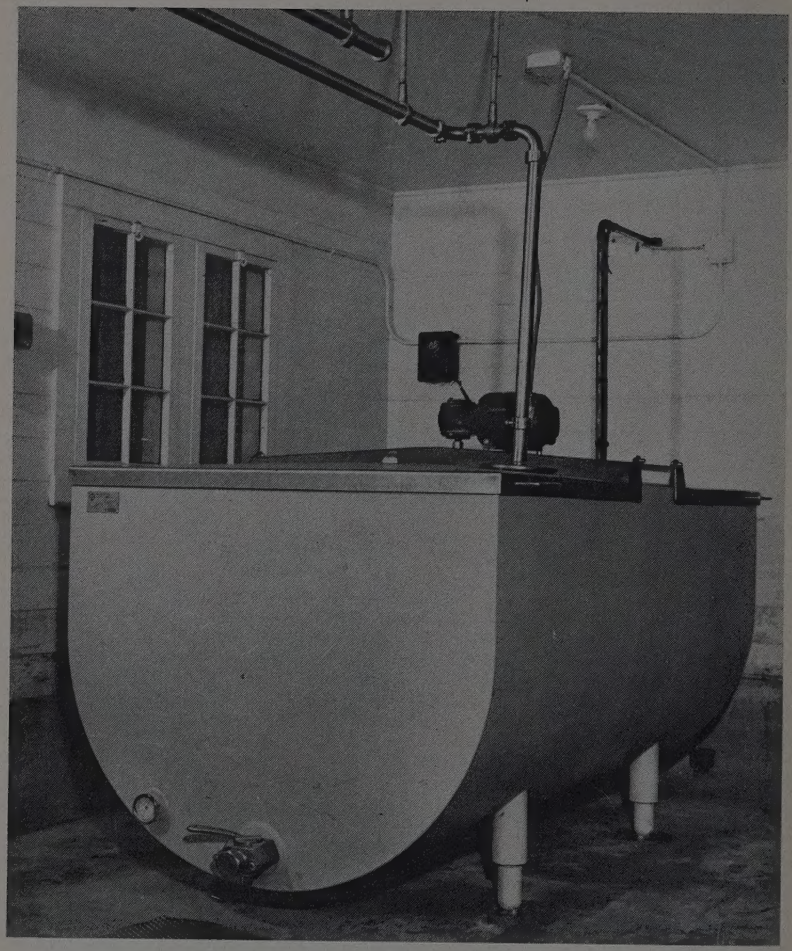
The circulating method is similar to the "air brush" process except that the solutions are forced through the entire system by means of a high-pressure pump.

The latest innovation in C. I. P. methods is a completely automatic cleaning device which operates on a time cycle principle similar to an automatic washing machine. After milking, the teat cups, milk tubes and other equipment to be cleaned are assembled above the solution tank, cleaning and sterilizing compounds are measured and added to the appropriate receptacles, the dial is turned and the device takes over. The dairyman can leave for breakfast or dinner knowing that the entire milking system will be rinsed, washed, sterilized, drained and ready for the next milking.

A logical companion to a pipeline milker is the refrigerated bulk farm milk tank. Bulk handling of milk was introduced into California many years ago, and now this State boasts a total of 3,550 farm milk tanks.

This method of handling milk has become so common that many processing plants now operate entirely on bulk milk with tanker trucks. There are no more milk cans in these plants. The cold milk is collected from the dairy farms in large stainless steel mobile tankers and hauled to the processing plant. At the plant it is pumped from the tanker to refrigerated holding tanks where it is standardized for milk fat content. The milk is then pumped through pasteurizers, clarifiers, homogenizers, coolers and bottlers without ever being exposed to

Mobile milk tanker. The last word in modern bulk milk transportation.



Bulk milk tank. It is stainless steel, insulated and refrigerated.

the atmosphere. The entire system operates by the use of automatic controls.

The farm milk tank and bulk handling of milk has brought on many problems from a regulatory standpoint. Space does not permit adequate treatment of the subject at this time, but it will be covered in a future issue.

Many devices have been developed for the purpose of weighing or measuring the amount of milk produced by each cow. The dairyman knows the importance of keeping accurate records on herd milk production. Cows which do not give enough milk to pay their way are likely to escape notice unless they are checked. This is usually done by accumulating the milk from individual cows into a bucket, weighing on a

scale and recording the weight. Cow testers follow this practice.

Those dairymen using a pipeline system have no need for milking-machine buckets except when the cow tester is operating, usually once a month, or when he is weighing the milk from each cow.

The new weighing or measuring devices are installed as a part of the pipeline system and collect the milk from each animal separately so it can be recorded before going through the pipeline and into the milk tank.

This device may be a glass jar suspended on a dial-type spring scale or a more complicated arrangement operated by use of electronic controls. Each is designed to make it easier and faster to keep individual records without sacrificing pipeline efficiency.

How the design of dairy structures and modern milking barn equipment has contributed to fast, economical milking was described in the *California Department of Agriculture Bulletin*, Volume XLIV—October, November, December, 1955, No. 4.

No discussion of "pushbutton" milking would be complete without a word about bulk feeding. One of the most important considerations in milk production is the cow's diet. In fact, the dietary habits of milking animals are much more carefully regulated than those of most human beings. It is common to feed animals concentrates such as grain, mill feed, cottonseed meal, copra, silage, etc. at milking time. This practice encourages the animals to come into the barn readily and to relax into contentment during the milking period. The dairy cow is customarily fed concentrates in proportion to her ability to produce milk. In other words, the high producers are fed more concentrates, and the low producers, proportionately less.

To convert the feeding job from a hand operation to a mechanical process meant eliminating the chore of hand weighing or measuring the specified amount of feed for each animal. Much progress has been made along this line, and many automatic feeding devices in use today are considered quite successful.

Feed is now available in pellet form which lends itself readily to bulk storage and handling. Overhead metal bins are usually provided so the feed can be conveyed through a downspout by gravity to the mangers in front of each cow. These bins

Overhead feed storage bin. Grain, concentrates and pelleted feeds are unloaded from bulk trucks, stored in the bin and dispensed by gravity.

are filled from bulk feed trucks, thus eliminating the handling of individual grain sacks. In many dairies, the cows are identified by a colored tag worn around the neck. The color indicates the amount of feed the animal is to receive, and the correct amount is dispensed by an automatic measuring device.

California dairymen have come a long way from the old three-legged milk stool, wooden shed and open milk bucket. The introduction of pipeline milking, bulk milk handling and automatic feeding has not only mechanized the dairy farm, it has revolutionized the whole dairy picture. The dairy business, once a family enterprise, has broadened to include large commercial operations that milk as many as 1,500 cows. The "pushbutton" concept has made it possible for fewer milkers to handle more cows, which has resulted in a trend toward larger herds and more milk.

The requirements of the Agricultural Code relating to dairy farms and dairy products have played an important part in placing California dairy foods among the Nation's finest. Rules and regulations for the enforcement of these provisions have been wisely kept flexible enough to be responsive to change. The provisions of the Administrative Code are frequently brought up to date after hearings called by the Director of Agriculture, for such regulations must allow for full freedom of inventive genius and new developments.

Through the intelligent enforcement of fair and reasonable dairy laws, the consumer is assured of a clean, wholesome, safe bottle of milk.

A New Armored Scale Insect on Elaeagnus From Texas (Homoptera; Coccoidea; Diaspididae)

SCALE STUDIES—PART XIII

By HOWARD L. McKENZIE, Systematic Entomologist,
California Department of Agriculture

During October, 1953, specimens of a new species of *Melanaspis* were submitted for identification to the taxonomy office of the California State Department of Agriculture by Mr. Herbert A. Dean, Entomologist, Texas Agricultural Experiment Station, Weslaco. The new species was found intermixed on the foliage of *Elaeagnus* sp. probably *pungens* (Thorny elaeagnus) with three other diaspidids, namely: *Aonidiella aurantii* (Maskell), *Hemiberlesia lataniae* (Signoret) and *Lepidosaphes beckii* (Newman). According to Mr. Dean the shrubs had lost many leaves resulting from the composite attacks of these scale insects. Apparently the new *Melanaspis* is host specific on *Elaeagnus*. A technical description of the species follows:

MELANASPIS ELAEAGNI McKENZIE, NEW SPECIES

Suggested Common Name. Black elaegnus scale.

Hosts and Distribution. Type and paratypes from *Elaeagnus* sp., probably *pungens* (Elaeagnaceae) collected at Harlingen (three-fourths mile south Dilworth Road), Texas, September 24, 1953, by H. A. Dean.

Type Material. Type slide (one specimen) and paratypes will be deposited in the United States National Museum, Washington, D. C. Additional paratypes will be deposited in the California State Department of Agriculture collection at Sacramento, California, and in the author's own collection.

Habit. Occurring on the leaves. Scale of the female circular, approximately 1.0 mm. in diameter, dark chocolate brown or black but overlain with a film of white wax, or of the epidermis of the plant, thus often appearing mottled with pale gray. Male scale elongate, similar in color, but smaller than that of the female, exuvium near one end.

Recognition Characters. Adult female as mounted averaging approximately 0.95 mm. long and 0.80 mm. wide; prosomatic region membranous at maturity; pygidium relatively broad, its dorsum presenting a definite pattern of sclerotization, appearing superficially as a rough cross, the lateral areas of which extend to the dorsal scar; perivulvar pores lacking; four pairs of well-developed pygidial lobes present, the median pair once-notched on mesal and lateral margin, the second and third lobes thrice laterally notched, fourth lobe broadest of all and usually notched four times on outer margin; pygidial plates short, poorly developed, two between median lobes, two between median and second, and two between second and third lobes, and finally normally four between the third and fourth lobes; dorsal pygidial macroducts few and slender, microducts situated ventrally, these ducts arranged as indicated in the accompanying illustration; paraphyses strongly developed, arranged as follows: a single moderately long and quite broad paraphysis arising from the mesal angle of each median lobe, a long slender paraphysis in the first interlobular space followed by a smaller one (approximately half as long) from the mesal angle of the second lobe, second space with a short paraphysis followed by one almost twice as long, and another short paraphysis arising from the mesal angle of third lobe, middle of third interlobular space with a long paraphysis followed by one or two short processes, beyond the fourth lobe

FIGURE 1. *Melanaspis elaeagni* McKenzie, new species. Collected on *Elaeagnus* sp., probably *pungens* (Elaeagnaceae) at Harlingen, Texas, September 24, 1953, by H. A. Dean.

A, pygidium of adult female; *B*, details of the dorsal aspect of the pygidial margin; *C*, habit; *D*, body of the adult female. Unlettered details are connected to their points of origin by guidelines and should be readily identifiable. The figures were prepared by the author.

four or five paraphyses of varying lengths; vulva situated slightly above midpygidium; anal opening small and removed from the margin by about one-fourth length of pygidium; prosoma with a sclerotized tubercle approximately opposite the posterior pair of spiracles, and with a dorsal cicatrix near margin on second abdominal segment; cephalothoracic area bearing a considerable number of microducts, particularly on ventral surface (see illustration).

Notes. This species is evidently quite closely related to *Melanaspis tricuspis* Ferris, but differs mainly in possessing a marked lateral lobing of the prepygidial abdominal segments, this lacking in the latter species. Other observed differences include normally four unbranched pygidial plates between third and four pygidial lobes, and a small, almost circular, anal opening in *elaeagni*, whereas in *tricuspis* there are only three pygidial plates between third and fourth lobes, and the anal opening is quite large and vertically oval. It is suspected that *elaeagni* may be host specific, which, if true, would aid in its identification. The only known host record for *tricuspis*, as given in the original description, is an undetermined woody vine.

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Protection of California Agriculture *

CHAS. V. DICK, Assistant Director,
California Department of Agriculture

Introduction of a new crop pest to an agricultural area usually results in lower yields, poorer quality, increased cost of production, or any combination of these factors. The end result may be loss of income to the producer, economic distress to the area involved, increased cost to the consumer, and a shortage of the commodity that is affected by the pest. Generally a serious pest outbreak in a major producing area results in very complex and far-reaching economic repercussions.

Government has provided three types of service to help prevent such occurrences, namely, research, extension and action programs. Research and extension are very essential parts of the whole program, but generally speaking they do not completely eliminate the impact of a new pest. Even though an effective chemical or cultural control may be developed, there still remains the cost of applying the control. There are exceptions, of course, such as in the case of some bioligical control projects which have been more or less self-sustaining after the parasites or predators were well established.

This points up the need for action programs, such as quarantine, pest detection and pest eradication—and that is what I am here to talk about. Perhaps it might be well to mention that in California we have, by mutual agreement and general understanding, a well-defined field of responsibility for each of the publicly financed agencies dealing with agriculture. The State Department of Agriculture at the state level, and the county agricultural commissioners, county

* Presented at Western Regional Meeting of Agricultural Research Service, U. S. Department of Agriculture, Berkeley, California, February 13, 1957.

sealers of weights and measures, and county livestock inspectors at the county level, handle the regulatory, service, and control work. The University of California, through its agricultural experiment stations and agricultural extension service, handles the research, biological control, and extension work.

California agriculture has long been aware of the importance of plant and animal quarantines and pest control. The first California plant quarantine law was enacted in 1881, and provided for the appointment of a viticultural health officer, who was empowered to declare and enforce quarantine regulations subject to the approval of the Board of State Viticultural Commissioners. This was more than 30 years prior to the enactment of the Federal Plant Quarantine Act of 1912.

Although the Plant Quarantine Act was not passed until 1912, despite repeated earlier attempts by California congressmen to obtain this federal legislation, there was nevertheless a Federal Insect Pest Act as early as 1905, and the U. S. Department of Agriculture had established a Division of Entomology in 1863 during the second year of the existence of the department itself. Actually, the first federal entomologist was appointed in the Division of Agriculture of the Patent Office in 1854—eight years before there was a U. S. Department of Agriculture.

Our first California livestock disease regulatory law was adopted in 1899, and provided for the office of State Veterinarian, and empowered that officer to make livestock quarantine regulations. On the other hand, a Federal Bureau of Animal Industry had been established as early as 1884, primarily for the purpose of eradicating pleuropneumonia in cattle.

I give this background information to show that control of crop and livestock pest diseases was recognized long ago as an essential function of the State and Federal Governments, and was, in fact, part of the basis for establishment of the U. S. Department of Agriculture and of the agencies which were later consolidated into a California Department of Agriculture.

California has an unusual need for plant quarantine protection and pest control because of the diversity of climate in this State, and the fact that we grow over 200 commercial crops in addition to our livestock and livestock products. Almost any new crop pest that might gain entry is quite likely to find the right host and environmental conditions somewhere in the State. From this standpoint we are quite vulnerable, but on the other hand our geographical location is such as to make practical the application of quarantine laws and regulations. We are bounded on the north and east by mountains, on the south by desert, and on the west by the Pacific Ocean, thus making entry of pests by natural means almost an impossibility. To gain entry, such organisms must be carried by man or animal, both of which means can be controlled to an appreciable degree by quarantine action.

With respect to plant quarantine and pest control, our state law defines pest as "any of the following that is or is liable to be dangerous or detrimental to the agricultural industry of the State: (1) Any infectious, transmissible, or contagious disease of plants, or any disorder of plants which manifests symptoms or behavior which the director, after investigation and hearing, finds and determines to be characteristic of an infectious, transmissible or contagious disease. (2) Any form of animal life. (3) Any form of vegetable life." It may be seen that this definition is broad enough to cover any form of animal or plant life or any virus disease of plants that may be dangerous or detrimental to our agricultural industry.

The state law also says that the director shall "prevent the introduction and spread of injurious insect or animal pests, plant diseases and noxious weeds." In an effort to accomplish this objective, we have set up a double line of defense. The first line is prevention of the introduction of new pests. We attempt to do this through our quarantine structure. Our second line of defense consists of a continuous program of pest detection to find incipient infestations of new pests so that we may proceed with eradication, if such action appears warranted.

Administration of the program of plant quarantine and pest control in California involves co-operation between the U. S. Department of Agriculture, the California Department of Agriculture, and the county agricultural commissioners. The latter are county regulatory officials who operate in certain phases of their work under the supervision and direction of the State Department of Agriculture.

Application of quarantine laws in California is aided by the geographical location of the State. California is bounded on the north and east by mountains, on the south by desert, and on the west by the Pacific Ocean, thus making entry of pests by natural means almost an impossibility. Photo, couresy University of California Agricultural Publications.

The county agricultural commissioner setup is unique in that it occurs only in California. In fact, these men, originally called county horticultural commissioners, were in the field several years before there was any such organization at the state level. Back in 1881, when the first California quarantine law was enacted, there was also enacted a law which provided for the appointment of county boards of horticultural commissioners. Under the quarantine law, the State Viticultural Health Officer, subject to the approval of the Board of State Viticultural Commissioners, had the power to make and enforce quarantine regulations. However the Legislature did not see fit to appropriate funds for enforcement of these regulations. In those days, mining, lumbering, etc., were important industries in the State, and there was some question as to whether agriculture would ever amount to very much. Therefore the Legislature took the view that, if agriculture wanted quarantine protection in local areas, the funds should be supplied locally. As a result, the county horticultural commissioners were appointed state plant quarantine guardians, and did all of the actual enforcement work in those early years. In 1889, an improved State Quarantine Law was passed, and funds were furnished for a state inspector at the Port of San Francisco. It was not until 1903, when the Office of State Commissioner of Horticulture was created, that the State itself really got into the picture of quarantine enforcement. As a result of this beginning, we now have in California an integrated system of state and county cooperation in the enforcement of quarantine and pest control laws.

Plant Quarantine

We have two general types of authority in plant quarantine inspection work. One is the power to make regulations governing movement of host carriers of specific pests, and the other is the power to take action against shipments based on the presence of pests or the likelihood of their being present. Quarantine regulations are placed in effect only after careful study of the need for such action, and after evaluation of the proposed restrictions, using as a yardstick the principles of plant quarantine adopted by the National Plant Board. They are also reviewed periodically to determine whether they may be modified or revoked. As a result, we believe that our regulations are constantly kept on a biologically sound basis.

For many years it has been our policy to allow entry under treatment and certification whenever a satisfactory treatment is known, rather than to prohibit such entry. At the present time we have 22 such formal quarantines directed against other states, and 15 directed against portions of our own State. Only six of the 22 quarantines have prohibitory features, and all of those, with one exception, are directed against plant diseases. We also enforce nine federal domestic quarantines which restrict the interstate movement of certain plants and plant products.

All nursery stock and other plant material capable of carrying pests, whether moved by nurseries or private individuals, are required to be held for destination inspection when entering or when moving within the State. Inspection is then made to determine compliance with state or federal quarantine regulations and to determine freedom from the pest concerned and from other pests not specifically quarantined against. An exception to the requirement of destination inspection is material moving under the so-called "pinto tag" program, by which nurseries meeting certain standards of cleanliness are permitted to ship stock within the State on the basis of certification at origin. This privilege applies only between counties participating in such an agreement, and is subject to certain restrictions as to the type of stock and the areas to which it may be so shipped.

Plant quarantine inspection is carried on in three different general areas of the State —at the borders, at the maritime ports, and at interior points.

Maritime inspection, which also includes airplane inspection, is handled by state crews headquartered at San Francisco, San Pedro, and San Diego. At the minor ports, where offshore ships dock only occasionally, the work is done by the local county agricultural commissioners. Maritime work includes foreign quarantine enforcement, as well as handling material from Hawaiian and other domestic ports. Enforcement of federal foreign quarantines is done under federal supervision with state men acting as collaborators. During 1955, 18,190 shipments arriving by vessel or airplane were rejected because they were infested with pests or did not comply with state or federal regulations.

Winterhaven border station. Border stations inspected 4,429,231 incoming vehicles during 1956.

Border inspection is handled at 16 permanent and one seasonal station on the main highways leading into the State. All of the stations are manned by state personnel. Plant material carried by motorists and bus passengers is inspected. Truckloads are cleared as to compliance with quarantine regulations, but the actual inspection for pests is usually made at ultimate destination by the local agricultural commissioner. In 1955 over four million vehicles, carrying over 11 million passengers, were inspected. Ninety-two thousand six hundred ninety-nine lots of plant material moving in violation of quarantine regulations or infested with pests were intercepted. Most of this number (81,444 lots) were declared by the passengers after they found out what we were looking for, but 11,255 addtional lots were found by actual inspection of the vehicles. We recognize that border inspection is inconvenient to the traveler, and is considered by some as an infringement of their constitutional rights. By instituting an on-job training program for our inspectors, we have been able to improve our public relations and reduce the number of complaints.

Rail, express, parcel post, and truck shipments moving interstate or intrastate are inspected at interior points by county agricultural commissioners acting under state law. In 1955, 11,949 interstate and 1,084 intrastate shipments were rejected, representing 5.6 percent and 0.9 percent respectively of the total number of shipments inspected. The incidence would no doubt be higher if shippers did not know that their material was subject to destination inspection.

People sometimes wonder if we actually prevent any "bugs" from coming in, or whether we are just stopping host material that might act as a carrier. In 1955, pests were found 12,557 times in material coming through our maritime ports, and 33,033 times at our border stations. All of these were not major pests, but our maritime inspectors did intercept 52 lots of fruit flies, 94 lots of citrus canker, 7 lots of golden nematode, and 39 lots of burrowing nematode, while our border inspectors intercepted 328 lots of apple maggot, 377 of cherry fruit fly, 50 of plum curculio, 59 of European corn borer, 25 of citrus white fly, 13 of sweet potato weevil, 15 of cotton boll weevil, and 9 of pink bollworm. Other serious pests were intercepted a lesser number of times.

We might try to evaluate our quarantine program in terms of one of the insects that we do not have. Since California is the only major cotton-producing state in the United States in which the cotton boll weevil does not yet occur, we might use this insect as a basis for evaluating potential loss. Last year California produced 1,400,000 bales of cotton, valued at $245,029,000, and several years ago the value in terms of cash receipts from farm marketings ran to over $300,000,000. Average annual loss due to boll weevil in the southern cotton-producing states is estimated by the U. S. Department of Agriculture as 10.4 percent. Applying this figure to the amount derived from cotton at current prices, the potential annual loss to California from the introduction and general establishment of the cotton boll weevil

would be between 25 and 30 million dollars. This would be the loss to one crop from one pest during one year. We estimate that the total cost of operating all of our border stations since their inception in 1921, including capital outlay for structures, has been about 10 million dollars.

Pest Detection

The State Department of Agriculture maintains four entomologists and three plant pathologists on a continuous full-time basis on pest detection work. Each is assigned to a district or area of the State to work with the county agricultural commissioners in training their personnel, and in developing and co-ordinating programs on a statewide basis to detect incipient infestations of new pests. The bulk of the manpower for these programs is furnished by the counties, and is augmented by seasonal personnel employed by the State.

These detection programs are separate and apart from the survey work necessarily associated with eradication projects and the determination of quarantine lines. They are also separate from the routine nursery inspection work carried on by agricultural commissioners under the guidance of state nursery inspectors. At one time during 1956 we had as many as 20,000 fruit fly traps in operation, in addition to the projects that require visual examination of host plants.

As previously stated, the objective is to detect incipient infestations of new pests—not to take an insect census or determine population densities. The programs are generally directed toward a specific pest, such as pink bollworm, golden nematode, burrowing nematode, Japanese beetle, fruit flies, and the like. When a new pest is found the same staff is used initially to delimit the infestation until such time as it is determined whether or not eradication should be undertaken.

I think that I should say at this point that the matter of pest detection is increasing in importance as time goes on. The Florida situation is probably the best current example of the importance of having a good detection program. The Mediterranean fruit fly infestation there was brought to official attention in April of last year by a householder who found a wormy grapefruit in his yard. At first it was believed that the infestation was localized in the vicinity of Miami, but by the time that the state and federal people were able to get a trapping program into full swing they found that they had over 1,500 separate infestations in 27 counties. The reports from Florida as to progress made toward ultimate eradication of the fly are very encouraging, but the project has cost a lot of money. Ten million dollars, half federal and half state funds, have already been made available for the project. These figures do not, of course, include the losses to industry occasioned by quarantine treatments and necessary readjustment of cultural and marketing practices, nor do they include the losses and inconvenience suffered by the public generally in Florida. I don't think anyone can say with certainty how much of this loss could have been averted by a good detection program, but I do believe that it would have been enough to have paid for maintaining such a detection program for many years.

Feeding cotton gin trash into machine for detection of pink bollworm. During 1956, state officials inspected 25,555 bushels of gin trash for the pink bollworm. No pink bollworms were found.

You might wonder why we don't just bolster up our quarantine effort and take care of the problem that way. Well, it appears to me at least, and I think to a great many other people too, that we are approaching the point where we can't continue to rely on quarantine inspection at points of entry to do the whole job for us. We must spread out in two directions if we are to cope with the difficulties presented by the developments taking place in transportation. Air transport is becoming a problem, both from the standpoint of the speed with which pests can be carried from one place to another, and from the stand-

point of pressures that are developing to keep us from slowing down that speed by our inspection procedures. The two directions in which we must spread ourselves are (1) to obtain better information as to pest conditions at point of origin, and insofar as practical to make point of origin inspections, and (2) to maintain adequate pest detection programs in the areas of destination.

I might digress here a moment to tell you that this transportation problem is not peculiar to the plant industry people—the livestock people are faced with it also. It used to be that most of the livestock and poultry imports were by surface craft, and diseased animals would die en route or at least were very likely to show symptoms of disease on arrival. Now practically all of the poultry imports and an increasing part of the livestock imports are by air. The trip by this method is often shorter than the incubation period of the diseases they might carry, so that the problem of inspection at destination has become further complicated by lack of symptoms.

Eradication

Insects, plant disease and weed pests toward which eradication effort is directed may fall into one of several categories. If eradication is purely of local rather than statewide concern, probably because the pest already exists elsewhere in the State, the problem is handled by the local agricultural commissioner, who relies on the State only for technical assistance. If the infestation is rather small and is confined to a nursery or other single piece of property, the commissioner usually handles the job even though the pest is of statewide concern. He may attain eradication by the expenditure of county funds, by requesting or requiring the owner to take certain action to abate the pest, or by a combination of both. Many incipient infestations of new pests have been eradicated by the commissioners in this manner without much having been heard about it.

When the pest under consideration for eradication is of statewide importance, and the scope of the project is beyond that normally handled by the commissioner, the State takes on the assignment, usually with the co-operation of the county. The degree of county co-operation varies, depending on the importance of the pest to that particular county. Often new pests of prime importance to a large segment of our agricultural industry are found in areas of the State quite remote from the main areas of production of the particular host crop. Examples are cherry fruit fly in Siskiyou County and western grape leaf skeletonizer in San Diego County. On the other hand, when Mexican bean beetle broke out in the heart of a 36,000-acre bean area in Ventura County, local assistance toward its eradication was immediately forthcoming.

Insect eradication projects currently receiving attention of the department concern cherry fruit fly in Siskiyou County, Hall scale in Butte and Yolo Counties, Khapra beetle on pretty much of a statewide basis, and Mexican fruit fly along our southern border. In addition, we are engaged in suppression of walnut husk fly in Sonoma and Napa Counties, pending further evaluation as to the feasibility of eradication. All of these are joint state and county projects with the Federal Government participating in the case of Hall scale, Khapra beetle, and Mexican fruit fly.

The separate eradication programs are as varied as the species with which they are concerned, and are planned with due regard for the specific biological characteristics of the pest. They do, however, have two major factors in common.

Six years has been arbitrarily established as the minimum period of operations. During the first three years, the treatment measures are applied to all hosts within a predetermined radius of a known infestation. The second three years are given over to intensive survey of the treatment area and its extended periphery to assure that there have been neither survival nor escapes. If at any time during this six-year period a live specimen of the species under eradication is found, in any stage, the entire six-year program is reinitiated. It may be practical to modify this arbitrary period of six years in dealing with certain of the fruit flies that have several generations in a single season. In such cases, we may be able to shorten the period of treatment.

Experience has shown that complete confidence cannot be placed in visual inspection, or even in trapping, in determining all existing infestation. For that reason, the treatment measures are extended to all hosts occurring within twice the radius of the anticipated seasonal spread of the species.

In the field of plant diseases we are currently attempting, with the co-operation of the agricultural commissioners concerned, to eradicate a virus disease of peach known as yellow leaf roll, which occurs in four counties in the peach bowl area of the Sacramento Valley. We hope that this effort will be more successful than the joint federal-state-county effort to eradicate peach mosaic in Southern California. In this latter case, we were able to reduce the incidence in commercial orchards to less than one-half of 1 percent, but it is apparent that we cannot completely eliminate the disease with presently known techniques. We are also engaged in stamping out several infestations of burrowing nematode that occur in nurseries.

In addition to our insect and plant disease projects, we are attempting the eradication of several noxious weeds on a statewide basis. In this work, State, county, and landowner each bear one-third of the cost.

When a pest becomes so widely distributed that we are no longer justified in applying eradication or intensive control measures at state or county expense, it then becomes the grower's responsibility to control it on his own property. As a means of protecting the growers, our laws permit the county agricultural commissioners to serve notices and cause the abatement of such pests when they are allowed to build up so as to constitute a nuisance to adjacent properties.

We do, however, spend state funds in the control of certain species of migratory insects, such as grasshoppers and the beet leafhopper, even though these pests may be of general distribution in the State. This is a policy that has developed over a period of years as it became obvious there were certain types of situations under which producers of important crops could not effectively protect themselves. Both of these pests build up on rangelands or wastelands that are often great distances from the crops ultimately attacked, and the properties on which they build up are owned or controlled by persons having no financial or economic interest in the pest problem that they present.

Important Insect Pests for Which California Should Be on the Watch *

By LELAND R. BROWN, Assistant Entomologist,
University of California, Los Angeles

During the summer and fall of 1955 I was privileged to have a sabbatical leave to one of the northeastern states, that is, New York. During this period I was fortunate, more or less as a sideline to my main study, to observe and record photographically several interesting and important insects which California does not have, at least to my knowledge. One exception to this and the reason for mentioning it will be noted in the following discussion.

It is probable, or we might even say axiomatic, that any insect which is not present in California and which attacks, or could attack, any cultivated crop or plant grown here, should be watched for by the people of California. To discuss adequately or just to list such tremendous numbers of different insects might take several volumes of books and obviously cannot be attempted here. Therefore the reader should keep in mind that the few insects mentioned here represent a highly arbitrary selection, accumulated in one relatively small geographical locality, during one relatively short growing season, and by only one observer in his spare time. And it should be noted that this observer's primary responsibility does not include quarantine or regulatory entomology. In fact the insects here mentioned are so restricted that they are all in one order—the Coleoptera or beetles. A number of appropriate and very interesting representatives of the Homoptera, Lepidoptera and Hymenoptera were also observed and photographed during my leave, but space will not permit their discussion here.

Probably most of you receive the weekly Cooperative Economic Insect Report from the U. S. D. A. in Washington, D. C. In reading this reort you have been curious undoubtedly about the various important insects not present in California. What do they do? What do they look like? Why are they considered so important? What would be their potential here? Well, I am certain I have been very curious about these matters. So you can possibly imagine the interest and enthusiasm I had in being able to observe and photograph these harmful and generally well-known insects in the very locality where they are important.

One of these insects has aroused my curiosity from my graduate student days at Cornell University, and this is the European chafer, *Amphimallon majalis* (Raz.) (see Figure 2). This scarab beetle or white grub is primarily a pest of natural sod and culti-

FIGURE 1. Cemetery turf in western New York showing severe injury from European chafer, *Amphimallon majalis;* grubs averaged six to eight per shovelful in this location.

* Presented as an illustrated talk before the fall meeting of the State Association of County Agricultural Commissioners and the State Department of Agriculture, November 28, 1956, at Sacramento.

FIGURE 2. Adults of the European Chafer, *Amphimallon majalis;* left, pair of females, and right, pair of males.

FIGURE 3. Adults of the Japanese beetle, *Popillia japonica;* females dorsally and male ventrally.

vated turf areas (see Figure 1). Throughout the Nation there is considerable interest manifested in this insect, likely as a result of the federal quarantine established against it in the summer of 1955. Although not as well known as some scarabs, such as the Japanese beetle, *Popillia japonica* Newm. (see Figure 3), the European chafer is nevertheless an increasingly important insect pest. When questioning an eastern entomologist who had worked with both of the foregoing insects, his comment of unmistakable meaning was: ". . . comparing damage of the two species, European chafer makes Japanese beetle look like a sissy!" Occasionally, as near some California airports, a Japanese beetle adult is caught in a trap. This creates quite a flurry of excitement among quarantine officials and entomologists, and rightly so—we certainly do not want such a serious pest to become established here. The same line of reasoning can be applied to the European chafer. Having observed large, heavily infested grass areas with little showing but the bare earth has convinced me that the chafer is an insect for which we should really be on the alert. On the chafer larva (see Figure

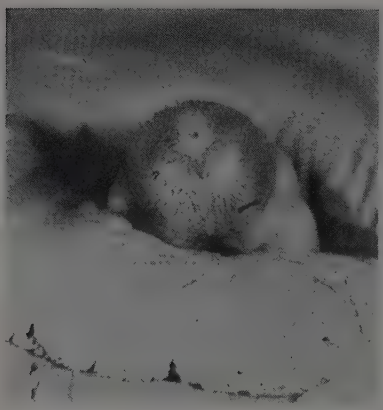

FIGURE 4. A posteroventral view of the last segment, or raster, of the grub of the European chafer, *Amphimollon majalis;* the arrangement of the small spines is typical of the species. This living larva was confined in modeling clay.

4), it is probably of interest to note the arrangement of the small spines on the raster; this particular arrangement serves to distinguish the species in this stage, I am told.

Another insect, also of European origin, that intrigued me was the smaller European elm bark beetle, *Scolytus multistriatus* (Marsh.) (see Fig. 5), especially its relationship to the Dutch elm disease caused by the fungus *Ceratostomella ulmi* Buis. Unfortunately this insect is already widespread in California, but the disease, most fortunately of course, is not here. This beetle has been in the United States since at least 1909, and has been spreading west since that time. Prior to 1951 it had progressed as far west as Colorado, and during that year it was found in San Jose, California—its first record in this State. Since 1951 it has been found in the middle of Los Angeles County and in the southern middle of San Bernardino County, in addition to the first record in Santa Clara County. It would not surprise me to find it in almost any elm-growing locality in California by this time. The smaller European elm bark beetle is a very vigorous pest, attacking trees only slightly weakened and apparently even those trees not weakened at all by any known factor. In appearance it is much like its near relative, the shothole borer, *Scolytus rugulosus* (Ratz.) (which is quite commonly distributed here), with the notable exception that *multistriatus* has the ventral keel. Any elm noted here with shotholes and with inner bark engravings as in Figure 6 has, in all probability, been attacked by the smaller European bark beetle.

In addition to the fact that the smaller European elm bark beetle is a vigorous pest, in New York its role as the principal vector of the Dutch elm disease is the cause for most concern with this beetle. This disease has been given much deserved publicity, but it is only upon observing the symptoms of this disease that one gains a real appreciation of its virulence. It is truly disheartening to observe huge, mature and stately elms killed as a result of infection with this disease. Many stumps remain in public parks

FIGURE 5. Adults of the smaller European elm bark beetle, *Scolytus multistriatus;* note the keel (like an exhaust tailpipe).

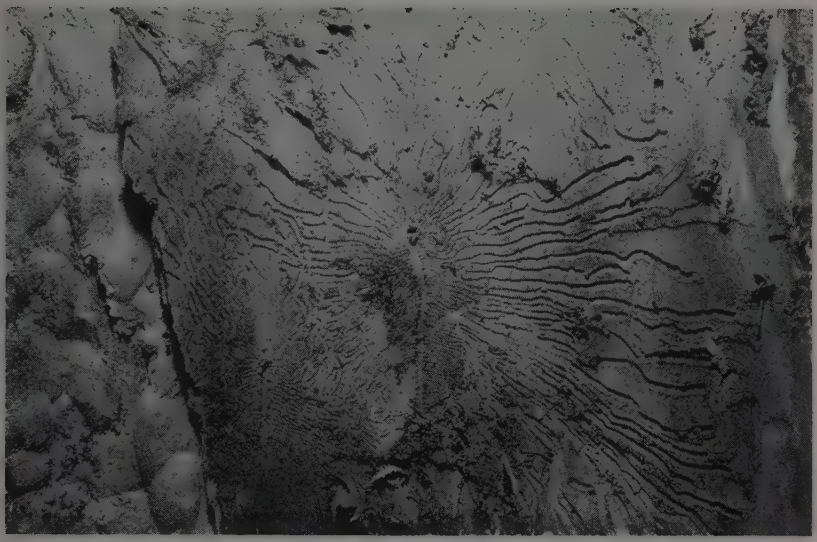

FIGURE 6. Typical engraving of the smaller European elm bark beetle, *Scolytus multistriatus*, on the inner bark; the single vertical tunnel is by the adult female and the numerous radiating tunnels by the larvae.

in New York as mute evidence of its destructiveness. Figures 7 and 8 illustrate the clogged and darkened vascular system characteristic of elms infected with the Dutch elm disease. Suffice it to say that we do not want this disease in California!

The Mexican bean beetle, *Epilachna varivestis* Muls., according to a recent article in this Bulletin by Mr. Armitage,* made its appearance in Ventura County, California, about 10 years ago. A concerted effort since then—and an expenditure of almost a million dollars—has effected what we hope is an eradication. According to Mr. Armitage this is cheap and with this the writer would agree, all factors considered, and especially since observing extensive and complete damage of this insect in the eastern United States. Figures 9 through 11 illustrate the life cycle and injury of this interesting phytophagous coccinellid beetle. To have expended this amount of effort and money leaves no doubt that the people of California want their crops to remain free of this serious insect pest.

An eastern insect pest of certain conifers that astounded me by its vigor and destructiveness is the white-pine weevil, *Pissodes strobi* (Peck) (see Fig. 12). Most species of pine and spruce may be attacked. The terminal growing shoots of smaller trees,

FIGURE 7. Cross section of a twig of *Ulmus americana* showing a discontinuous ring of darkened vascular tissue, this being a symptom of infection by the Dutch elm disease organism.

* Chief, Bureau of Entomology 1944-1955 (retired).

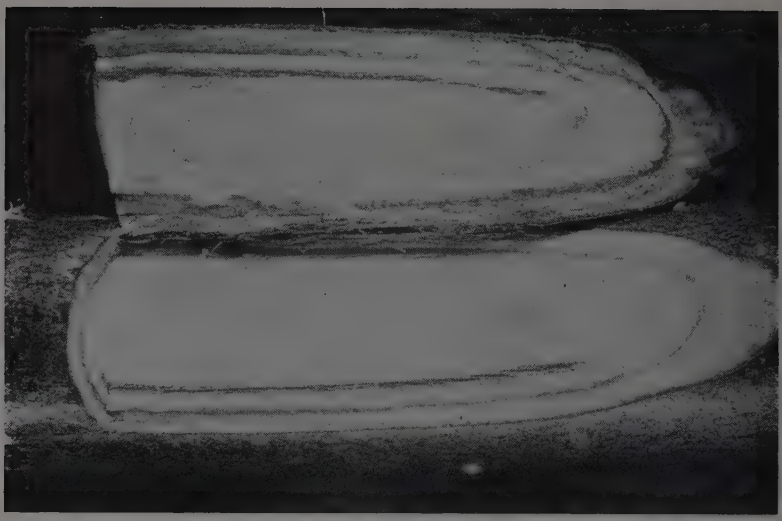

FIGURE 8. A longitudinal section chip of the same twig as in Figure 7 showing a streak of darkened vascular tissue from the Dutch elm disease.

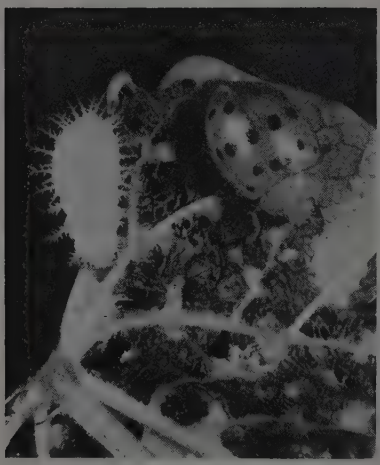

FIGURE 9. Larva, adult and their damage of the Mexican bean beetle, *Epilachna varivestis*.

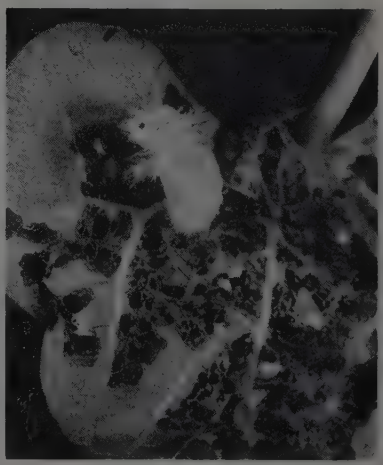

FIGURE 10. Pupa of the Mexican bean beetle, *Epilachna varivestis*, on an injured bean leaf.

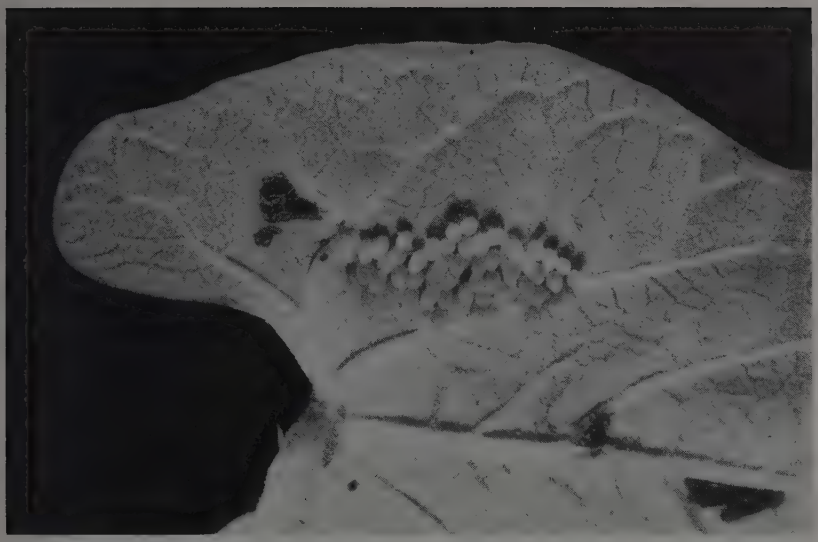

FIGURE 11. Eggs of the Mexican bean beetle, *Epilachna varivestis*, on the lower leaf surface of bean.

3 to 15 feet high, seem to be preferred for attack, and of these, trees that are outstanding in some respect, such as being slightly taller than their neighbors or in an open areas. Such weevil attacks render young conifer reproduction in the forest worthless for future lumber, and because of the resultant distorted growth conifers grown for ornament are of little value. As shown in Figure 13 the adults cause much bleeding of the terminal twig by their feeding and egg-laying activities. The larvae very effectively consume the sapwood and vascular tissue of the terminal, thus girdling and killing it, while the larvae near pupation further weaken the terminal by burrowing into the heartwood to construct pupil chambers, as shown in Figure 14.

The locust leaf miner, *Chalepus dorsalis* Thunb., see Figures 15 and 16, was of considerable interest to the writer in that we have no common Californian beetle as a pest occupying a comparable habitat. In California leaf miners representing Lepidoptera, Diptera and at least one Hymenopteran are fairly common but coleopterous leaf miners

FIGURE 12. Adult of the white pine weevil, *Pissodes strobi*.

FIGURE 13. White pine twigs showing bleeding resulting from adult feeding and ovipositional punctures of the white pine weevil, *Pissodes strabi*.

FIGURE 14. White pine twig split open to show pupae of the white pine weevil, *Pissodes strobi*, in their cells in heartwood.

are a comparative rarity. Concerning the locust leaf miner the writers recalls one locust-lined highway in eastern New York which was severely damaged for several miles, both skeletonizing damage of the adults, as in Figure 15, and leaf mining damage of the larvae, as in Figure 16. A number of similar areas throughout that state were also noted. Much of the locust growing in the area of the northeastern United States is in natural stands, whereas locust grown in California is cultivated, at least to a degree. For this reason alone it would be unfortunate to add another burden to locust culture by the introduction of the locust leaf miner to California.

In conclusion the writer would like to make clear that the purpose of this article is certainly not to instill fear of, or create unnecessary excitement concerning, the insect pests mentioned. Its purpose is merely to inform in a more or less popular manner. A course of action—if there need be one—based on intelligence is much preferred to one based on fear.

FIGURE 15. Adult and its feeding injury and larval mining injury of the locust leaf miner, *Chalepus dorsalis*.

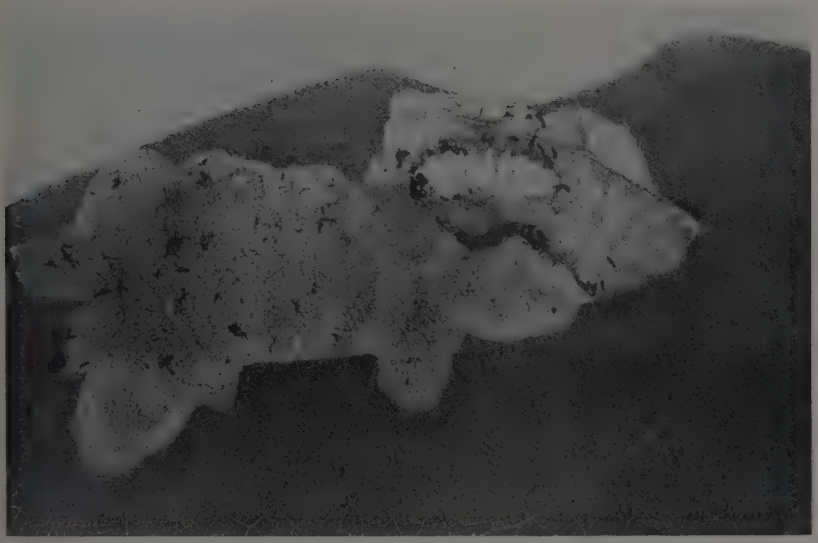

FIGURE 16. Larva of the locust leaf miner, *Chalepus dorsalis*, exposed in its mine.

Witchweed, Striga Asiatica, a Green, Seed-producing, Higher Plant Parasitic on Corn and Certain Other Crops

By CARL W. NICHOLS, Associate Plant Pathologist, and GILBERT L. STOUT, Chief, Bureau of Plant Pathology, California Department of Agriculture, Sacramento

The parasitic, chlorophyll-bearing, seed-producing, higher plants, commonly known as witchweed and belonging to the genus *Striga*, are widespread in the tropics and subtropics of Australia, Africa and Asia (1, 5, 6) where they cause serious damage to crops, mainly in the grass family. Recently, a species of *Striga*, identified as *S. asiatica* (L) Kuntze (2, 6) was discovered parasitizing corn and crabgrass in North and South Carolina (2, 3, 5, 6). This is the only area where the parasite is known to occur in the United States, but this species of *Striga* has been reported previously in the Belgian Congo, Ceylon, China, India, South Africa, Southern Rhodesia, Sudan, Tanganyika, and Viet Nam (5).

Whenever the term witchweed is used hereafter in this paper it refers only to *S. asiatica*.

Some of the crop plants grown in California which could be attacked by this witchweed are corn, oats, rice, sorghum, sudan grass and wheat (1, 5).[1] The combined estimated value of these crops in California in 1956, other than when grown for hay, was $117,820,000.[2] This evaluation does not include our valuable tame pasture grasses, some of which are known to be hosts of the witchweed (see Table 1). In order to protect these valuable California crops from this pest, it is important that we be constantly on the alert for it in the fields where these crops are growing so that we may detect and eliminate incipient infestations.

[1] Barley, *Hordeum vulgare*, California's most valuable grain crop, has not been reported as a host of the witchweed; however, a species of *Hordeum, H. intermedium*, has been reported as a host (5).

[2] This value was obtained from the California Crop and Livestock Reporting Service of the California Department of Agriculture.

Symptoms and Signs (1, 2, 3, 5, 6)

Plants parasitized by witchweed develop symptoms similar to those resulting from a lack of water and nourishment. They become stunted, wilt and turn yellow (Figs. 1, 2). Fleshy, white to purplish, stemlike structures can be found intertwined with the host plant roots (Fig. 3). If a host plant is parasitized by many witchweed plants it may die. In cases where corn is the parasitized host, the parasite can be distinguished from the roots of the host by a difference in color. The belowground portions of the witchweed are white to purplish in color, while the corn roots are darker or brownish. A bulb-shaped, appressoriumlike swelling of the witchweed plant occurs where it is attached to the host root (Fig. 4C).

In infested fields, bright green witchweed plants with orange-red (sometimes white or yellow) flowers are found. These plants are attached below the soil surface to the roots of the distressed host plants. The witchweed plant is described in more detail below.

The Parasite (1, 5, 6)

A single witchweed plant may produce as many as 500,000 seeds. These seeds are extremely small, almost microscopic. After the seed has been produced, a dormancy period of several months usually is necessary before the seed will germinate. After the period of dormancy, germination still usually does not occur unless the seed is associated with roots of the host plant. It is thought that the ger-

FIGURE 1. Effects of *Striga* on yield of corn. A normal stalk of corn held with its base on the ground in the midst of *Striga*-parasitized corn plants. Note the height of the normal plant as compared with the dwarfed, dry, parasitized plants. Photo courtesy of South Carolina Agric. Exp. Stat., Clemson, S. C.

mination is stimulated by secretions from the host plant roots. The witchweed seedling must come in contact with and become attached (Figs. 3, 4C) to a host plant before the witchweed plant will continue to grow. After attachment to the root, the witchweed plant will continue to grow underground for a period of about 30 days. During this time, the young seedling is dependent on the host plant for its food and water. After the witchweed plant has emerged from the soil, it develops chlorophyll in the leaves and can manufacture its own food, but it still is partially dependent upon the host plant for water and minerals.

After emergence aboveground, the witchweed plants become bright green. They usually are about eight to nine inches in height; however, some may reach 18 inches. The leaves are narrow and slightly hairy (Figs. 3, 4B). Their upper and lower surfaces look alike. The aboveground stem has four slight ridges (Fig. 4B) giving it a square appearance when observed in cross section.

About 30 days after the witchweed has emerged from the soil, flowers (Fig. 4b) appear, first near the base and then in the upper portions of the plant. Each flower has an irregular two-lipped corolla. The upper lip has two small lobes, and the lower lip has three larger lobes. The color of the flowers that have been observed on the plants in North and South Carolina is predominantly orange-red. Shades of pink and yellow also have been seen. About four weeks after the flowers first appear, the seed capsules (Fig. 4a) mature and rupture, scattering the seed over the soil for the next month or so. Flowering and seed production continue until cold weather occurs and kills the annual witchweed plant.

Host Range

Seeds from witchweed plants parasitizing corn and crabgrass in North Carolina have been induced to germinate in soil in the greenhouse, where the resultant seedlings have parasitized corn, sorghum, sweet sudan (sudan grass), carpetgrass, crabgrass, Johnson grass, sandbur, foxtail millet, barnyard grass, Japanese millet, goosegrass and rescuegrass (6). Many other hosts have been re-

FIGURE 2. Closeup of corn plant with witchweed plants growing at its base. The witchweed plants are attached to the corn roots below the soil surface. Photo courtesy Dr. H. R. Garriss, North Carolina State College.

ported for *Striga asiatica* in other countries (5). A list of the reported hosts is included in Table 1.

Control (2, 5, 6)

Since witchweed is not known to occur in California, our best method of control at this time is to be constantly on the alert to find and eliminate incipient infestations of the pest.

In localities where this pest has become established, it has been recommended that susceptible host crops not be replanted in infested fields except if used as "catch crops." A "catch crop" is one which will stimulate the witchweed seed to germinate, and will support the parasite's growth. However, where such a crop is used it must be plowed under before the witchweed can produce seed. If this practice is repeated a number of times, the amount of witchweed seed in the soil can be greatly reduced.

TABLE 1

Host Plants Reported for the Witchweed Plant, *Striga asiatica*

Family	*Scientific name*	*Common name*
Gramineae	*Andropogon annulatus*	Angleton bluestem
	A. caricosus	India bluestem
	A. monticola	....
	Aristidia adscensionis	Sixweek threeawn
	**Avena sativa*	Oats
	Axonopers affinis	Common carpetgrass
	Brachiaria distachya	Signalgrass
	**Bromus catharticus*	Rescuegrass
	**Cenchrus* sp.	Sandbur
	Chloris gayana	Rhodesgrass

* Reported in California.

TABLE 1—Continued

Host Plants Reported for the Witchweed Plant, *Striga asiatica*

Family	*Scientific name*	*Common name*
Gramineae	**C. virgata*	Feather finger grass, showy chloris
	**Cynodon dactylon*	Bermuda grass
	**Dactylis glomerata*	Orchardgrass
	Digitaria melangeana	----
	D. sanguinalis	Hairy crabgrass
	**Echinochloa crusgalli*	Barnyard grass
	E. frumentacea	Japanese millet
	Eleusine aegyptiaga	----
	E. coracana	African millet, ragimillet
	Eragrostis sp.	Lovegrass
	E. abyssinica	Teff
	Eriochloa polystacha	Myêt-kyein
	Euchlaena mexicana	Mexican teosinte
	Eurochloa heliopis	----
	Hordeum intermedium	----
	Imperata arundinacea	Satintail
	**Oryza sativa*	Rice
	Panicum brizanthum	----
	P. colonum	Wumbè-sa-myêt
	Panicum coloratum	----
	P. distachyum	Myêt-lú
	P. flavidum	----
	P. isachne	Domakalu gaddi
	P. maximum	Guineagrass
	**P. miliaceum*	Hog millet
	P. miliare	Shavan, lu, kutki
	P. prostratum	Zein-myêt
	P. repens	Torpedograss
	**Paspalum dilatatum*	Dallisgrass
	P. scrobiculatum	India paspalum
	P. virgatum	Switchgrass, tolquezal
	Pennisetum glaucum	Pearl millet
	P. typhoideum	" "
	P. unisetum	----
	Saccharum officinarum	Sugar cane
	**Secale cerale*	Rye
	Setaria gerrardii	----
	S. italica	Foxtail millet
	S. lindenbergiana	----
	S. nigrirostris	Black bristlegrass
	S. phleoides	----
	S. sphacelata	Musumbwe
	Sorghum conspicuum	----
	**S. halepense*	Johnson grass
	**S. sudanense*	Sudan grass
	**S. vulgare*	Sorghum
	Sporobolus coromandelianus	Myêt-mon-hrnwa
	**Stripa* sp.	Needle grass
	Tragus racemosus	Stalked burgrass
	**Triticum vulgare*	Wheat
	**Zea mays*	Corn
Leguminosae	*Indigofera glandulosa*	Indigo
Amaranthaceae	*Celosia argentea*	Cockscomb
Commelinaceae	*Commelina hasskarlii*	Day flower
Tiliaceae	*Corchorus fascicularis*	----
Cyperaceae	**Cyperus rotundus*	Purple nutgrass
Convolvulaceae	*Ipomea reniformis*	----
Zygophyllaceae	**Tribulus terrestris*	Puncture vine

* Reported in California.

FIGURE 3. Corn root and attached witchweed plant. The short diagonal corn root is attached to the base of the perpendicular witchweed plant. The underground portion of the witchweed stem is white, rounded and fleshy; the aboveground portion has four slight ridges giving the stem a square characteristic. The witchweed leaves are small and narrow. Photo courtesy of Dr. H. R. Garriss, North Carolina State College.

"Trap crops," such as cowpea and soybean, also have been used. These crops will stimulate the witchweed seed to germinate, but they will not support the witchweed, which dies shortly after germination. It has been recommended, however, that such crops, if harvested, should be utilized only in the infested area or on the farm where the crop is grown.

Weed hosts, such as crabgrass, should be eliminated from infested fields even though a nonhost crop is being grown. In the absence of a host crop, the witchweed can complete its life cycle on the weed hosts.

Noncultivated areas and cornfields found to be infested with witchweed can be treated with a herbicide such as 2,4-D (2,4-dichlorophenoxyacetic acid) applied at a rate of one pound per acre. If crops with a low tolerance to 2,4-D are nearby, the witchweed can be killed by spraying it with a herbicide such as DNBP (2,4-dinitro-6-*sec*-butylphenol) at the rate of two pounds in 10 gallons of diesel oil plus 30 gallons of water per acre.

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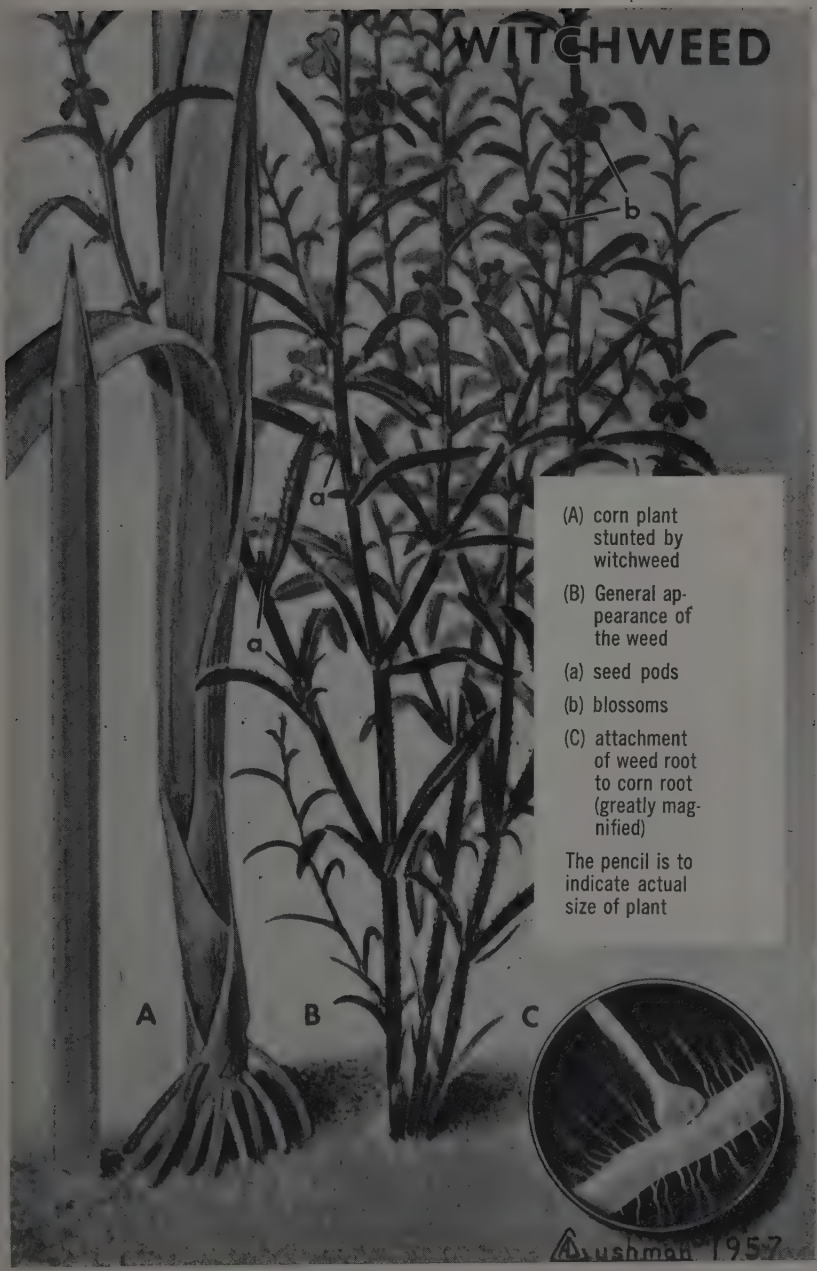


FIGURE 4. A drawing of a witchweed plant adjacent to its corn plant host. An enlargement of an attachment between a corn root and the witchweed plant is shown in the lower right-hand corner. Photo reproduced by permission from U. S. Dept. Agric. Publication PA-331.

Eriophyid Studies XXV

By H. H. KEIFER, Systematic Entomologist,
California Department of Agriculture

This paper describes seven new mite species. Four have been sent to me from other areas for description, one is of local interest in connection with virus transmission studies on fruit trees, while another, the juniper berry mite, was previously unreported from California.

Anchiphytoptus beeri Keifer, New Species

Plate 249

Female 390-410μ long, 50-60μ thick, very elongate, wormlike, dull yellow. Rostrum 28μ long, curved down. Cephalothoracic shield 36μ long, 45μ wide, with admedian lines indicated to rear, otherwise smooth. Anterior shield setae 30μ apart, 7μ long, projecting diagonally ahead. Dorsal tubercles 24μ apart, ahead of rear margin; dorsal setae 4.5μ long, projecting up. Forelegs 35μ long; tibia 5μ long, with seta and spur; tarsus 5μ long; claw 7μ long, straight; featherclaw 7-rayed. Hindlegs 35μ long, tibia 4.5μ long, tarsus 5μ long, claw 10μ long. Anterior coxae separate; rear coxal setae in transverse line. Abdomen with about 75 rings, the microtubercles elongate and nonacuminate, in longitudinal lines dorsally. Subdorsal seta 7μ long, on ring 8; lateral seta 31μ long, on about ring 5; first ventral 50μ long, on ring 17; second ventral 40μ long, on ring 34; third ventral 45μ long, on ring 6 from rear. Accessory seta present. Female genitalia 33μ wide, 30μ long, coverflap smooth, seta 5μ long.

Type locality: Antiguo Morelos, Tamaulipas, Mexico. **Collected:** June 18, 1956, by R. E. Beer, University of Kansas, for whom the species is named. **Host:** *Beaucarnea stricta* Lem., Liliaceae (*Nolina*). **Relation to host:** The mites are presumably found in the leaf bases. Type slide so designated, with the above data. Paratype slides six in number. The new species differs from the genotype, *lineatus*, not only by size and host but also in having two more rays on the featherclaw.

Trisetacus quadrisetus (Thom.)

This is the widespread juniper berry mite which proves to be Holarctic, having been originally described from Europe. It forms a gall within the infested berry, destroying the seed and producing a minute terminal escape hole. On many infested Sierra junipers which the writer has examined it is difficult to find an unattacked berry. In a list of insects of New York, 1928, M. D. Leonard lists this mite from Ithaca.

Sierra Juniper, *Juniperus occidentalis* Hook., seems to be the most heavily attacked species in California. Collections by the writer are at Twin Bridges, El Dorado County, August 12, 1952, and at Sandy Camp, Hat Creek, Shasta County, August 17, 1952. Recently, C. V. G. Morgan, Canadian Department of Agriculture, has sent samples of *quadrisetus* from Vancouver Island. The host is *Juniperus scopulorum* Sarg., and the collection date April 1, 1956.

Acerimina Keifer, New Genus

This genus has the characters of *Aceria* except for the absence of seta I on the anterior coxae.

Genotype: *Acerimina cedrelae*, New Species

Acerimina cedrelae Keifer, New Species

Plate 250

Female 200μ long, 50μ thick, short, wormlike, dull yellow. Rostrum 23μ long, curved down. Shield 30μ long, 47μ wide, with a distinct pattern on most specimens; median line present to rear; admedians complete, undulating; about three submedian lines visible, interspersed short dashes; sides of shield somewhat granular. Dorsal tubercles 33μ apart, on rear margin; dorsal setae 13μ long, projecting backward. Forelegs 38μ long, tibia 10μ long, with seta; tarsus 7μ long; claw 8μ long, knobbed; featherclaw 4-rayed. Hindlegs 35μ long, tibia 8μ long, tarsus 7μ long, claw 8μ long. Anterior coxae broadly connate; second setae ahead of a transverse line through third setae. Abdomen with about 55 rings, the microtubercles acuminate. Lateral seta 12μ long, on about ring 8; first ventral seta 58μ long, on about ring 19; second ventral 11μ long, on ring 33; third ventral 35μ long, on ring 6 from rear. Accessory seta present, minute. Female genitalia 23μ wide, 16μ long, coverflap with about 10 longitudinal furrows; seta 17μ long.

Damage to hackberry by *Aceria snetsingeri*

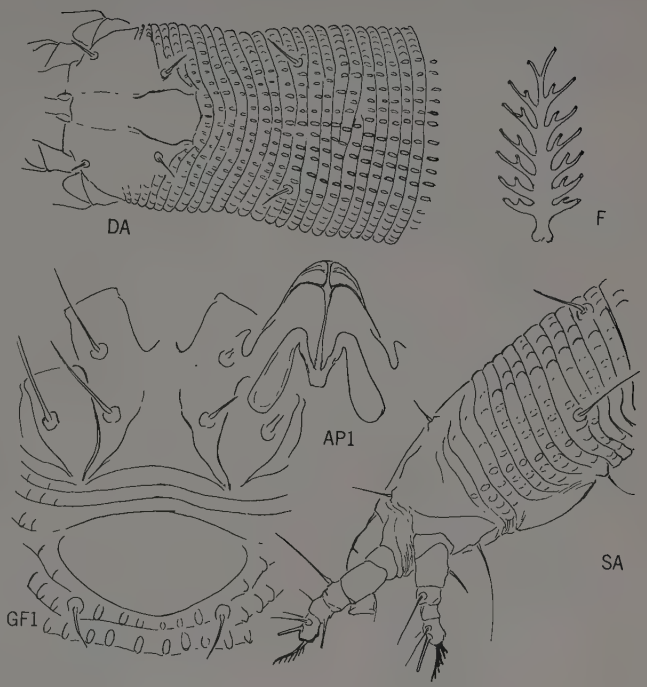


PLATE 249—*Anchiphytoptus beeri*, new species

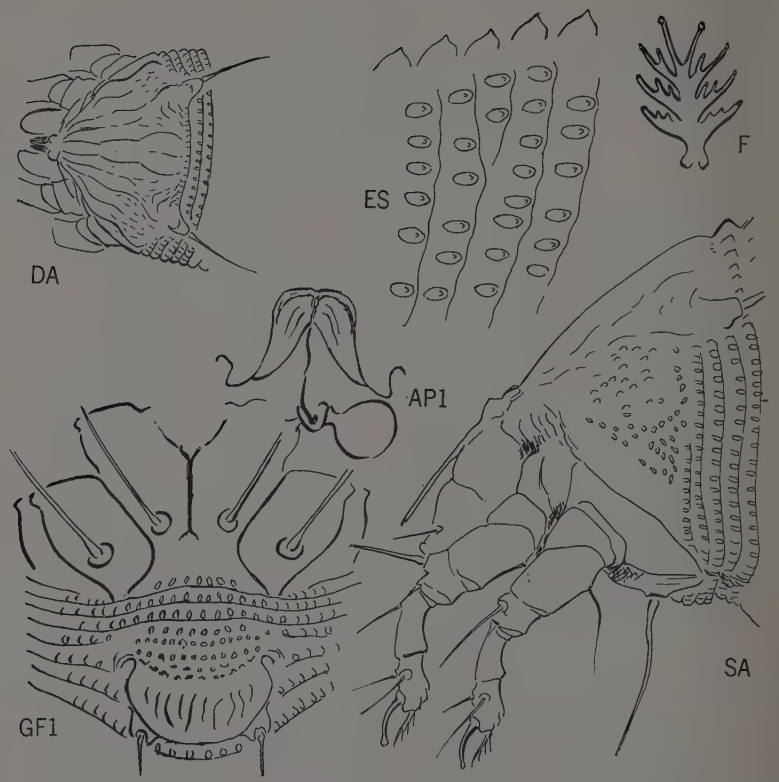


PLATE 250—*Acerimina cedrelae*, new species

Type locality: Jilliby, New South Wales. **Collected:** December 8, 1956, by K. M. Moore. **Host:** *Cedrela australis*, Meliaceae. **Relation to host:** The mites form clusters of irregular bead galls on the leaves. **Type slide:** So designated, with the above data. **Paratype slides:** Three in number.

Aceria snetsingeri Keifer, New Species

Plate 251

Female 200-205μ long, 40μ thick, wormlike, light yellow. Rostrum 20μ long, curving down. Shield 20μ long, 28μ wide, without markings except for slight indication of median line on rear margin. Dorsal tubercles 21μ apart, on rear margin; dorsal setae 22μ long, projecting diagonally out and backward. Forelegs 23μ long, tibia 5μ long, with seta at midpoint; tarsus 5μ long, claw 6μ long, curved and slightly tapering; featherclaw 5-rayed. Hindlegs 20μ long, tibia 4μ long, tarsus 5μ long, claw 7μ long. Anterior coxae touching; setae II far ahead of a line through setae III. Abdomen with about 55 rings, the microtubercles large, rounded. Lateral seta 16μ long, on about sternite 5; first ventral 16μ long, on about sternite 14; second ventral 7μ long, on sternite 26; third ventral seta 23μ long, on sternite 7 from rear. Accessory seta present. Female genitalia 19μ wide, 10μ long, coverflap smooth, seta 7μ long.

Type locality: Bradley, Illinois. **Collected:** March 20, 1956, by R. J. Snetsinger, Illinois Natural History Survey. **Host:** *Celtis occidentalis* L., hackberry, Ulmaceae. **Relation to host:** The mites form a witches'-broom with numerous short shoots bearing buds

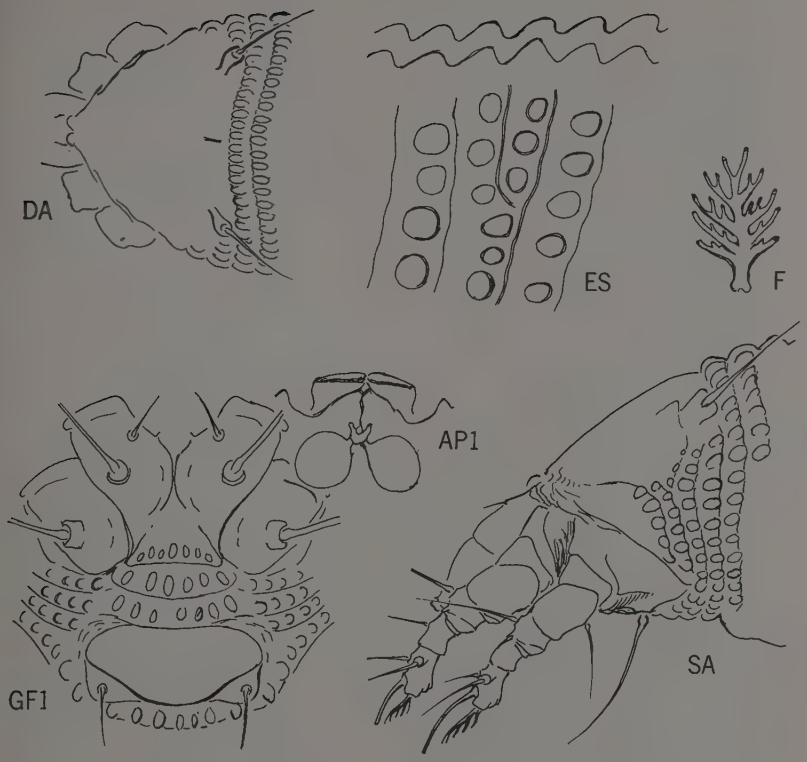


PLATE 251—*Aceria snetsingeri*, new species

but no leaves. Type slide so indicated, with the above data. Four paratype slides. The mite has a combination of distinctive characters: shield lacking a design, large microtubercles, smooth female coverflap, and 5-rayed featherclaw. The species is named for Robert Snetsinger, who asked me to describe the mite.

Eriophyes hybridicola Keifer, New Species

Plate 252

Female 175-200μ long, 40μ thick, short, wormlike, dull yellowish. Rostrum 23μ long, curved down. Shield 29μ long, 34μ wide, the design well marked: median line present on rear half, ending in a faint dart-shaped mark; admedians close, undulating, further apart to rear; submedians irregular but approximately as follows: first submedian short; second submedian undulating, ending about in front of dorsal tubercle; additional lines and dashes just lateral to tubercle, one of which roughly parallels the second submedian, enclosing a dash or two ahead of dorsal tubercle. Shield laterally granulate, the central section margined by the usual curved line of granules. Dorsal tubercles 14μ apart, slightly ahead of rear margin; dorsal setae 20μ long, projecting ahead. Forelegs 26μ long; tibia 5.5μ long, with seta; tarsus 6μ long; claw 6μ long, with a slight knob; featherclaw 4-rayed. Hindlegs 24μ long, tibia 4.5μ long, tarsus 6μ long, claw 6μ long. Abdomen with 60-65 rings, completely microtuberculate, the microtubercles rounded; 7-8 microtubercles in a 10μ distance. Anterior coxae touching; coxae granular, the median setae ahead of a line through the rear coxal setae. Lateral abdominal seta 26μ long, on about ring 8; first ventral 35μ long, on about ring 21; second ventral 7μ long, on about ring 37; third ventral 19μ long, on ring 5 from rear. Accessory seta present. Female genitalia 23μ wide, 15μ long, coverflap with 10-11 longitudinal furrows; seta 12μ long.

Type locality: Wolfskill Ranch, Winters district, Solano County, California. **Collected:** April 25, 1956, by D. Y. Rosenburg,

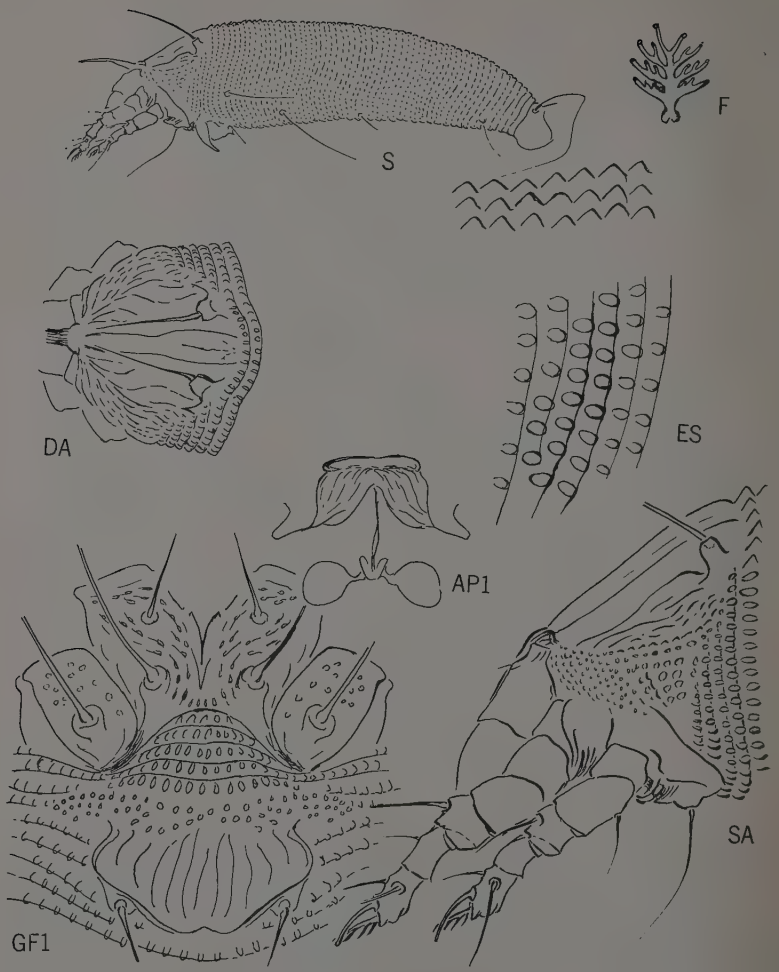


PLATE 252—*Eriophyes hybridicola*, new species

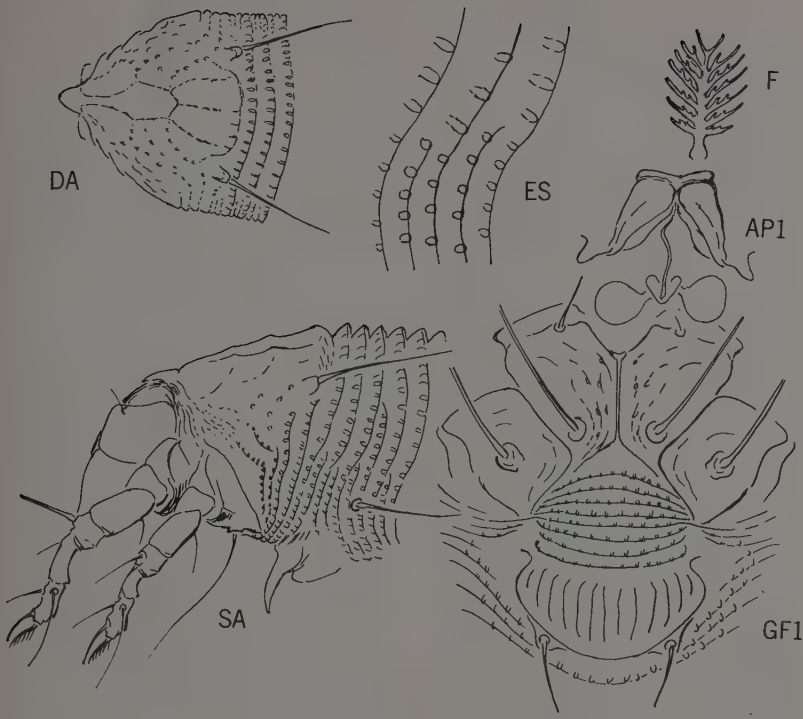


PLATE 253—*Vasates rhodensis*, new species

State Department of Agriculture. **Host:** A *Prunus* hybrid known as elephant heart. **Relation to host:** The mites inhabit the buds and petiole bases on new growth. Type slide so designated. Four paratype slides with the above data. In addition there are several slides of mites collected the same day by the writer on other *Prunus* hybrids such as the Nona variety, and on *Prunus angustifolia*. The mite is of interest in connection with possible virus transmission studies. It differs from two previously described mites on *Prunus*, namely *insidiosus* and *prunidemissae*, by the lateral shield pattern. *Eriophyes insidiosus* has a dart-shaped mark laterally on the shield, and *prunidemissae* has but a slight mark at that point.

Vasates rhodensis Keifer, New Species

Plate 253

Female 180-200μ long, 50μ thick, spindleform, light dull yellow. Rostrum tapering, curved down, 30μ long. Shield 38μ long, 38μ wide, anterior lobe short and acuminate; median line present on rear third, originating from a V-shaped line from the admedians; admedians complete, undulating; submedians represented by tubercles (as are the central lines) but these granules are not particularly indicative of lines; lateral side of shield with some lines of microtubercles and granules. Dorsal tubercles 32μ apart; dorsal setae 27μ long. Forelegs 38μ long; tibia 10μ long, with seta; tarsus 7μ long; claw 6μ long, small terminal knob; featherclaw 7-rayed. Hindlegs 34μ long, tibia 7.5μ long, tarsus 7μ long, claw 7μ long. Coxae somewhat granular; anterior coxae touching; first setae far ahead; second setae well ahead of transverse line through the third setae. Abdomen with about 33 tergites and 60-65 sternites; microtubercles on both tergites and sternites, being elongate dorsally; microtubercles blunt.

Lateral seta 25μ long, on about sternite 6; first ventral 38μ long, on sternite 22; second ventral 28μ long, on sternite 40; third ventral 30μ long, on sternite 5 from rear. Accessory seta present. Female genitalia 20μ wide, 15μ long, coverflap with about 14 longitudinal furrows, seta 15μ long.

Type locality: Newport, Rhode Island. **Collected:** August 4, 1956, by John P. Keifer. **Host:** *Salix* sp. (This is a white pilose willow.) **Relation to host:** The mites are very numerous in the white leaf hairs. Type slide so designated with the above data. Paratype slides three in number. There is also the dry material as received bearing numerous mites. The new species is characterized in part by the 7-rayed featherclaws (empodium). The California species with 7-rayed featherclaws have pointed microtubercles, which is not the case with *rhodensis*.

Vasates celtidis Keifer, New Species

Female 175-190μ long, 55μ thick, spindleform, dull yellowish. Rostrum 24μ long, projecting down. Shield 45μ long, 50μ wide, anterior lobe acuminate and downcurved; shield design absent, the surface smooth. Dorsal tubercles 28μ apart, on rear margin; dorsal setae 28μ long, stiff, projecting backward. Forelegs 35μ long, tibia 7.5μ long, seta present; tarsus 7.5μ long; claw 7.5μ long, with a small knob; featherclaw 5-rayed. Hindlegs 33μ long, tibia 4μ long, tarsus 5μ long, claw 7μ long. Coxal setae II and III almost in line; setae I well anterior and small. Abdomen with about 29 smooth tergites. From 50 to 55 sternites with numerous microtubercles which are slightly acuminate. Lateral seta 10μ long, on about sternite 16; first ventral seta 35μ long, on about sternite 16; second ventral 11μ long, on about sternite 30; third ventral 15μ long, on sternite 4 from rear. Accessory seta present, minute. Female genitalia 25μ wide, 18μ long, coverflap with about 8 longitudinal furrows; seta 28μ long.

Type locality: Bradley, Illinois. **Collected:** March 20, 1956, by R. J. Snetsinger. **Host:** *Celtis occidentalis* L., hackberry. **Relation to host:** The mites appeared in preparations which consisted mainly of the mite described above as *Aceria snetsingeri*, indicating the species is a vagrant, lurking in crevices in the witches'-broom, and perhaps also found on the leaves of hackberry. Type slide so indicated, with the above data. Paratype slides, two in number. The closest species with which the writer is acquainted is the California mite, *ambrosiae*, on ragweed. The new species differs in having a larger anterior lobe, in having no indication of microtubercles on the tergites, and in having less diagonal furrows on the coverflap.

Eriophyid Studies XXV is part of a series. The 24th installment appeared in the *Bulletin*, Vol. XLIV, No. 4, p. 159, 1955.

Designation on plates:

AP1—Interior female genital structures
DA —Dorsal view of anterior part of mite
ES —Side view of skin structures
F —Featherclaw (empodium)
GF1—Coxae and female genitalia
S —Side view of mite
SA —Side view of anterior section of mite

*Standardization Enforcement * In Los Angeles Markets*

HAROLD J. RYAN, County Agricultural Commissioner,
Los Angeles County, California

Enforcement of the standardization provisions of the State Agricultural Code in California markets is done by county agricultural inspectors qualified for appointment by state examination. Regional supervising inspectors of the State Department of Agriculture are responsible for seeing to it that uniform standards of inspection are followed by the counties.

California law sets up specific minimum standards for each of 43 commodities in addition to eggs, honey and, as of July 1, 1956, poultry meat. It prohibits deception in the packing, labeling, display, or advertising of all fruit and vegetable products.

Two important items that govern inspection manpower requirements in Los Angeles are carlot unloads which reached 125,000 in 1956 and the number of truckloads going out of State for which we issue standarization compliance certificates. There were 24,000 of these last year.

Naturally the carlot unloads at Los Angeles have increased at about the same rate as the population. During the 20 years ending with 1950-51, unloads went up 64 percent while the population went up 60 percent.

Most of the inspection of incoming produce is done at three wholesale markets. There are 6,000 retail markets in the Los Angeles area, and nearly all of these get their supply through the wholesale markets.

About 20 percent of the unloads come in by rail. As much of this as possible is inspected at three team track yards during the morning, while it is still in the cars.

Probably 15 percent of the incoming produce goes directly to 31 chain store docks. These docks distribute to 696 retail outlets. Five hundred twenty-eight of these are in Los Angeles County. Some of the others are out of State. For example, one of the chains makes six deliveries a week to Las Vegas, Nevada. Our inspectors make spot checks once a week or oftener at each of these receiving docks. Daily coverage of course is maintained at the three wholesale markets.

The normal fruit and vegetable inspection force in Los Angeles, of about 20 men, builds up to 25 or more during the summer months. About half their time is put in on inspection of outgoing produce and the issuance of standardization certificates for which a fee is collected.

In order to avoid possible California inspection at the border stations virtually every motor truck carrying produce out of the State carries a certificate.

The average outgoing truckload is approximately two-thirds of a rail carload, and the total of 13,792 certified loads that moved out to the 10 western states and Canada in 1955-56 was just 3 percent greater than the number of Los Angeles market carlot unloads in 1956 that originated in these states. Of the total interstate movement of certified loads out of Los Angeles, these states got 58 percent while they shipped us 52 percent of the market unloads that came from out of State.

California produce accounted for 80 percent of all Los Angeles unloads. The balance was about equally divided between the other western states and all other areas.

If our inspectors run into produce trouble that came with the shipment they are most likely to find it in the early morning hours.

Some chainstore receiving docks operate 24 hours a day. Some open at 2 o'clock a.m.

* Delivered to the twenty-third annual Western Area Standardization Conference in Denver, Colorado, June 10, 1957.

The wholesale markets open at 5 a.m. Pacific daylight time and at 6 a.m. in the winter when we are on Pacific standard time.

All produce, regardless of origin, has to meet California marking requirements and quality standards. If it is marked with U. S. grade it must meet that grade requirement. Reconditioning or remarking is required unless the owner prefers to divert to by-products or for livestock feeding or ship the load back to point of origin. Contrary to some reports, we would usually prefer to see the return of rejected produce that originated out of State. We would rather have you see it if it was rejected here than have the shipper give you his opinion of its quality.

We particularly welcome the immediate inquiry of the state officer of origin the moment he gets any report of a rejection if he doesn't fully understand the reason for it. We have been especially grateful for the occasional visits from out-of-state shippers while the produce in question was still available for inspection.

Without a prompt inquiry from the state of origin or a visit from the shipper, we find that some vague tale of an improper rejection or enforcement neglect will wander about from state to state for weeks and months in a most frustrating manner. The story never accumulates any dates or names or specific descriptions that will permit identification, and so we never have a chance to meet it head on.

Watermelon inspection at team track.

Almost every year we've had several visits at the market from aggrieved or skeptical shippers while the rejected produce was still there so we could look at it with them. They've come from as far away as Washington State and Florida and as close as the next county.

Whenever this has happened the shipper has always either agreed that the rejection was entirely justified, or, at the worst, he has conceded that our application of the California law was reasonable even though he might think that the law itself was too tough. We take some satisfaction from this and we'd like to have more visits of that kind.

The inspectors go down the line in the markets, examining produce as they come to it, regardless of where it originated. They do not discriminate against out-of-state produce, though it is perhaps only natural that the out-of-state shipper whose produce is rejected should suspect that he is being "picked on."

With this criticism in mind, we have tabulated the figures for 1955-56 of carlot unloads and wholesale market rejections in three commodities that are received in considerable volume each year and usually account for quite a number of rejections. These are cherries, apples and potatoes, and the figures apply only to unloads from the member states in the western area.

The rejection totals are not complete. We have tabulated only those for which the origin is clearly identified in our records, and we have not included any rejections made in retail markets.

	Carlot unloads	*No. of rejections*
Cherries	301	83
Apples	4,893	233
Potatoes	15,918	205

Percentages by Origin of Total Unloads and Rejections

	Cherries		*Apples*		*Potatoes*	
Origin	*Unloads*	*Rejections*	*Unloads*	*Rejections*	*Unloads*	*Rejections*
California	77	31	22	38	68	64
Idaho	20	60	6	16	20	6
Oregon			8	1	6	7
Washington			58	38	3	17
Canada			5	4		
Other	3	9	1	4	3	6
Total	100	100	100	101	100	100

I would not suggest for a moment that this represents a typical year. There isn't any such thing. However, the figures do seem to show that terminal inspection is not rougher on out-of-state produce than it is on the homegrown product.

After the inspectors have finished their early morning assignments they move out of the central district to make inspections at the retail stores.

Here they may find substandard commodities that escaped inspection at the initial distributing point, or they may run across some sharp practice that originated with a store owner.

The growth of the supermarket, and with it the self-service display, has done much to cure the old problem of deceptive display, but it is still with us.

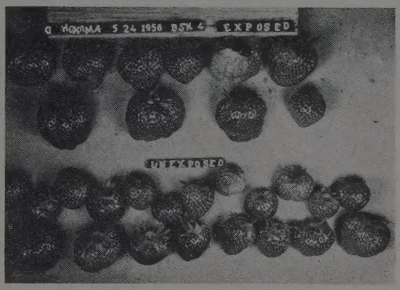
For example, there is one very big display market in downtown Los Angeles with leased stands handling a tremendous variety of foodstuffs. They say they serve 250,000 customers a week. Some 17 stalls handle fresh produce with as many as 10 clerks to a stall that may occupy 800 square feet, including a carefully prepared display. A tall customer can look over the display and just see the clerk from the elbows up. Here the hand does not need to be quicker than the eye because the customer isn't permitted to touch the display nor to select anything from it. The purchase is picked by the clerk from behind the counter.

This market is a story by itself. It takes a very measurable portion of the inspectors' time to avoid the complaints that come immediately if our coverage here is inadequate.

The roadside stand which is sometimes an offender, and is usually a handler of produce of marginal quality, is still with us, along with the neighborhood grocery which, however, is seldom in trouble with the law.

We have seasonally from 80 to 100 roadside peddlers who sell from trucks on vacant corner lots. Their number is growing less, perhaps because there are fewer vacant corner lots on busy thoroughfares. The peddler always needs watching because he is here today and gone tomorrow and has to buy marginal produce to compete with the quantity buying of the increasing number of big markets. The inspectors aren't sad to see his tribe decrease, and one reason is that they have to take turns at Saturday and holiday shifts to cover his operations.

Deceptive pack strawberries—Exhibit A used as evidence.



Deceptive pack strawberries—exposed and unexposed berries—Exhibit B used as evidence.

We can usually get a conviction on any clear case of deception if our evidence is good.

The law allows reconditioning of most produce that fails to meet minimum standards or is incompletely marked. Reconditioning or other legal disposal of the produce is in itself a penalty.

Last year there were 19 hearings held at the city attorney's office or in our office which resulted in release of the offender with a warning, because the offense was not considered serious enough to take to court, or because the evidence was insufficient.

There were also 19 prosecutions and 17 convictions. A prosecution for misuse of a disposal order on an order of cull pears where the owner had given a fictitious address resulted in a conviction by a jury and a $300 cash fine.

Six prosecutions for deceptive displays of tomatoes, apricots, grapes and lettuce at the big central retail market brought cash fines of from $10 to $100.

Two strawberry growers got cash fines of $25 for putting up deceptive packs.

For wholesalers were prosecuted—one paid a $25 fine for selling decayed strawberries, another paid $10 for selling celery in crates with incomplete markings, another was fined $25, suspended, for mismarking the count of artichokes, and one paid a $250 cash fine for changing the count on Washington apples from 138 to 125.

Four egg law prosecutions, bringing fines ranging from $20 to $250, made up the 17 successful cases.

One of the two cases we lost was a deceptive display complaint dismissed by the court because we could not prove legal ownership of the produce.

The other was a severe disappointment to us. Shortly before last year's meeting at McCall, Idaho, we found a dealer putting Utah potatoes in Idaho sacks.

Since any false or misleading marking on a container is unlawful, we are just as much concerned with the mismarking of out-of-state produce as if it originated in California and we have had, over the years, several successful prosecutions for this offense.

In this instance our inspectors found sorters, in a place operated by the defendant, grading potatoes out of sacks marked in part "U. S. No. 1 Utah potatoes" and putting the larger potatoes in sacks labeled in part "Idaho potatoes U. S. No. 1 grown in Idaho." The defendant admitted to inspectors at the time that he was the owner and in charge of the operation. Idaho U. S. No. 1 potatoes were quoted that day at $3.75 to $4.25 and U. S. No. 1 Utah's at $3.50 to $3.75.

The district attorney and our department were so sure of a conviction that they let the case go to the court on the basis of the arrest report. This precludes examination of witnesses.

To our great chagrin the attorney for the defense did not plead the defendant guilty and argued that possession only had been proved. Fortified by a legal opinion that mere possession of illegal produce is not unlawful, the judge found the defendant not guilty.

We are sure that the testimony of our inspectors would have gotten a conviction if we had not made the tactical error of being too sure too soon.

A more satisfactory mislabeling case was the prosecution a few years ago of a citrus packer for marking grapefruit "Coachella," the name of a California district from which grapefruit usually commands a market premium.

The preparation of any case takes a lot of time and care. This one was the result of unusually careful preparation.

State inspectors watched the fruit picked and put into field boxes which they had marked. They saw it loaded into a truck which they followed 200 miles to the packing house in Los Angeles County. There, by prearrangement, they met the county inspector. He took over the job of following the fruit into storage, through the sweat room, across the grader, and under the stamping machine that labeled it "Coachella." While the fruit was being put in boxes for shipment the county and state inspectors gathered to witness the final operation of the packer before he went to court where he paid a $250 cash fine after the jury was out 10 minutes.

In the prosecution of cases of deceptive pack, deceptive display, and mislabeling we have used colored slide photographs as evidence, with very satisfactory results. We've also gotten considerable value out of the use of colored slides for the training of new inspectors.

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